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A FAMILIAR

TREATISE

ON

LIFE ASSURANCES AND ANNUITIES,

BY ROBERT RANKIN.

MDCCCXXX.

FULLER, PRINTER, BRISTOL.

A FAMILIAR

TREATISE

ON

LIFE ASSURANCES AND ANNUITIES,

COMPRISING

A Historical Sketch

OF

THE SCIENCE, AND OF LIFE ASSURANCE OFFICES,

WITH

OBSERVATIONS ON THE DURATION OF HUMAN LIFE, AND OTHER OBJECTS OF INTEREST CONNECTED WITH THE SUBJECT:

TO WHICH ARE APPENDED

ORIGINAL TABLES

OF THE

PROBABILITIES AND EXPECTATIONS OF LIFE IN THE CITY OF BRISTOL, ETC.

BODLEIAN LIBRARY

BY ROBERT RANKIN,

Secretary to the Bristol Union Fire and Life Insurance Company.

London:

SIMPKIN & MARSHALL, STATIONERS' HALL COURT;

AND

WILLIAM BROWNE, CLARE STREET, BRISTOL.

MDCCCXXX.

713.

TO THE

VERY REVEREND HENRY BEEKE, D. D.

DEAN OF BRISTOL,

ONE OF THE VICE PRESIDENTS

OF THE

BRISTOL PHILOSOPHICAL INSTITUTION,

IN TESTIMONY OF THE HIGH REGARD IN WHICH HIS

FAVORABLE OPINION IS HELD,

THIS TREATISE,

INTRODUCED THROUGH HIS AUSPICES TO THE

NOTICE OF THAT INSTITUTION,

IS RESPECTFULLY INSCRIBED BY

THE AUTHOR.

Park-House, Clifton,
June 1st, 1830.

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PREFACE.

In the year 1818, when the establishment of the first, and as yet the only Life Assurance Office in Bristol, was in contemplation, I was desirous of ascertaining the rate of mortality prevailing in the probable field of its principal business, relatively to that of the metropolis; and with that view, extracted from the burial registers of this City and its suburbs, the number of deaths at every age during the preceding five years, a period practically sufficient for an average in a place of this magnitude.

From these data, Tables of the probabilities and expectations of life were deduced, which, when compared with the

published probabilities and expectations of life in the metropolis, evinced a decided superiority, so decided indeed, as (when coupled with other considerations,) satisfactorily to warrant the adoption of a scale of premiums, ten per cent. below those taken by the London Offices generally, and on this reduced scale the office was established.

Although fully satisfied on principle, that an average of five years was sufficient, I felt a natural curiosity to see the correspondence of the next term of five years with it, and was therefore induced to undertake the task of ascertaining it; and the result exhibited a coincidence, even surpassing by its minuteness, my most sanguine expectations.

With the fruits of my labors in some degree methodized, and with some Tables founded on them, or illustrative of them by comparison, I presented the Bristol Institution: they consisted of

1. A Table of the actual numbers who

have died within the proposed limits during the ten years, from 1813 to 1822 inclusive, distinguishing the two periods of five years.

2. A Table of the probabilities of life deduced from the first period of five years.

3. A similar Table for the second five years.

4. A similar Table for the whole period of ten years.

5. A Table similar to the last, but proportioned to the number of 10,000 as an original radix, together with a Table of deduced expectations.

6. A Table of probabilities derived from the private or Undertakers' Burying Grounds, with the corresponding expectations.

7. A similar Table for the Parish of St. George, Kingswood.

8. A similar Table for the Parish of Clifton.

9. A Table of the value of an annuity

on a single life at every age, agreeable to the probabilities in Table V. at 3, 4, 5, and 6 per cent.

10. A comparative Table of expectations in various places.

11. A comparative Table of the numbers attaining each age, out of a thousand contemporary births at various places.

12. A Table of the probabilities and expectations of life in the Society of Friends.

The whole of these Tables, 10 and 11 excepted, are original; and though *recording* them here may not be superfluous, the following selection is sufficient for the purpose of this publication; namely, 1. 5. 6. 7. 8. and 12.

With a view to illustrate the utility, not so much of the Tables in particular, as of all authentic information of a similar nature, and with a persuasion that many points of interest to the philosopher and philanthropist may be elicited from a subject whose practical application, it must be confessed,

is often laborious and uninviting, the following Treatise was composed.

At the present day, the several advantages of Life Assurance are generally well appreciated; at least we may conclude so, from the greatly increased number of Offices, and their extensive business.

There is, however, reason to believe, that many who contribute to the revenues of Life Assurance Companies, either consider the premiums an arbitrary price for their policies, or have merely a vague and indistinct notion of the principles on which they have been calculated; nor is this extraordinary, when we look at the great diversity in the terms of the different Assurance Offices, which, to many persons unacquainted with the subject, would imply either ignorance of the science in those who ought to have a knowledge of it, or imperfection in the science itself; neither of which, however, is the case.

The real cause of the diversity, is the want of correct data for the practical ap-

plication of the science, or, in other words, the want of a Table exhibiting the true rate of human mortality, all the Tables at present extant, being only approximations; and until this desideratum is supplied, which sooner or later it will be, the spirit of competition will not only tend to continue such diversity, but will in all probability increase it.

To obtain business, new Offices have been induced to hold out allurements in various shapes; some allowing the assured to participate in the profits; some deducting a per centage from the usually required premiums; some, by a reduction of the premiums in the earlier stages of life, and an augmentation of them on the more advanced ages, and so forth, apparently without any regard to the rate of mortality exhibited in the Tables, at present extant. When, however, the desideratum alluded to is supplied, (a consummation devoutly to be wished, for the security both of the assurers and the assured,) it will, like the beacon to

the mariner, hint in very intelligible language, that destruction awaits those who approach too near: an illustration of this will be found in Table No. VII.

To account for the very circumscribed acquaintance with the subject of Life Assurance and Annuities, two reasons may be offered: the first is, that those whose pursuits preclude deep study, or who are interested in literature of a different character, (deeply learned and scientific though they be,) may be unwilling to attack the standard works on the subject; and the second reason is, that many general readers turn from the subject as crude, severe, and algebraic; and the very word algebra, whether from its eastern sound, or its apparent fantastic, unintelligible combinations and complications of letters, occupying as it does, the *ultima thule* of tutors' assistants, a *terra incognita* to many who have had a common school education, jars upon the ear as cabalistic, perpetuating in some degree the mysteries of the once dreaded grammaree.

But to be serious. Though Life Assurance and Annuity calculations may be excused, if they do not, *prima facie*, appear inviting, connected with them are many phenomena highly interesting; facts of local and universal importance, and illustrations which do not present the appalling shape of skeleton formulæ.

This little Volume is offered to the Public, in the hope, that part of the obstacles at least, to a more general investigation of the subject, (a subject affecting the pockets of so many thousands in this kingdom) may be removed; and I trust, that, while the size of it is not formidable, the matter which it contains will be found both interesting and instructive: I hazard it forth the more confidently, as the bulk of it has been favorably received by the Literary and Philosophical Society of this City, in whose Library the original MS. is deposited.

TREATISE.

CHAPTER I.

SKETCH OF THE MATHEMATICAL DEPARTMENT OF THE DOCTRINE OF ANNUITIES AND LIFE ASSURANCES.

THE doctrine which we are about to consider, rests entirely on the scientific application of two familiar truths, which may be termed its axioms; namely, that a present payment is more valuable than a future one, and a certain payment, than an uncertain one.

If any sum, say one pound, be absolutely receivable at the end of a year, the present value of it is clearly that sum which improved at interest for a year will amount to one pound; so, if one pound be receivable at the end of one, two, three, four, or one hundred years, the

value of it is still the sum which will increase to one pound within the given time, by being improved at interest.

This estimation may correctly be called discounting the expectant sum, but must be distinguished from the commercial practice of discounting; as, in the latter, the interest, or discount, is computed on the expectant sum, instead of the present value, which, scientifically speaking, is inaccurate.

As interest, when actually paid, may be converted into principal, it follows, that the computation of imaginary interest for the purpose of discounting an expectancy, should suppose this to be done at proper periods, and accordingly, whenever, in treating of this subject, interest is expressed, *compound* interest is meant.

The intervals of conversion may be more or less frequent, and, in some cases, half-yearly or quarterly periods are assumed; but the general rule is, to add the interest to the principal every year.

Hence, in whatever ratio the improved amount of one pound increases, in any term of years, the present value of one pound payable at the end of the term, will diminish in the inverse ratio; but the successive improved amounts at the end of the second, third, or fourth years, &c. being the successive powers of the amount of one pound for a year, the successive present

values will be the successive powers of one pound discounted for a year; and these two series will denote the ratio of increase or diminution, whatever be the absolute magnitude of the sums so improved or discounted.

If then any given sum be payable at the end of one year, an equal sum at the end of two, three, four years, &c. and so on to the end of a given term, the present value of each payment may be ascertained, and the whole summed up, thus determining the value of an annuity certain, which such a series of payments would constitute; but as these values keep diminishing in a constant ratio, they fall into a regular series in geometrical progression, and may be briefly summed up by the usual rule, so that the value of no payment but the last, need be calculated; for, by subtracting this value from an entire payment, and dividing by the interest of one pound for a year, or, in other words, multiplying by the perpetuity, the value of an annuity is found.

On these simple principles are constructed Tables which are in the hands of almost every one, exhibiting the present values of expectancies and annuities certain for any short term of years, at various rates of interest; and from a table of annuities certain, the values of deferred annuities may be found by simple subtraction; for an annuity for five years to commence after

a term of ten years, manifestly coincides with an annuity for fifteen years, less the first ten payments, and its value, is the difference between the value of an immediate annuity for fifteen years, and one for ten years.

These three cases, of an expectancy, a present annuity, and a deferred annuity, are sufficient to illustrate this part of the subject, as they are, in fact, the principal cases arising out of it; and it will appear sufficiently plain from what has been said, that, either the amount, present value, term, or rate of interest of an annuity is ascertainable, provided the other three be given; if the term, or rate of interest is required, logarithms are necessary; and, indeed, for most operations in the science they are highly useful.

The questions concerning contingent payments, are of a more complicated nature, as they involve a proper allowance for uncertainty upon each payment, besides the allowance for remoteness already considered.

Probabilities, it is well known, are represented by fractions, bearing the same proportion to unity, which the probabilities themselves are supposed to bear to certainty. Suppose, for instance, a man entitled to receive a sum of money twenty years hence, if then living; now, if the probability of his so living be expressed by half, that is, if it is as probable that he will be living

as that he will be dead, the present value will be half that of a *certain* payment to be made twenty years hence; for the value, is obviously equal to the value of such a sum dependent on his death, and the sum of these two values must coincide with the value of a sum certain; thus the value of a sum, payable at the end of any fixed term of years, but depending on some contingency, is universally found, by multiplying the sum by the probability, and discounting the product.

If, then, a person of a given age be entitled to receive one pound at the end of every year from the present time, as long as he lives, the value of the first payment is the probability of the life continuing one year, discounted for one year; the value of the next payment is the probability of the life continuing two years, discounted for two years; &c. &c.; and the value of each payment, up to the remotest period of life which may be reckoned morally possible, being thus separately calculated, the sum of the whole will be the value of the annuity, expressed in pounds and parts of a pound, according to the universally received notation; and, as the integers of this expression are equivalent to entire yearly payments, it is said to denote the number of years purchase which the annuity, or popularly the life, is worth.

This laborious process of computing the value of an annuity on a single life, the most common and useful problem in the science, being surmounted, ulterior operations are greatly facilitated; for, from an annuity table alone, the value of a life assurance is deducible; from an annuity table, and a table of the probabilities of life, the value of a deferred annuity; hence the value of a limited annuity; and from these the values of limited and deferred life assurances; and these are nearly all the important questions which occur when one life only is concerned.

A life assurance, if originally computed, would require a similar but reverse process to that which is necessary for a life annuity: the death of the party must happen in some particular but unknown year; therefore the probability of its happening in the first year, discounted for a year, gives the first year's chance; the second year's probability, discounted for two years, the second year's chance; and the operation being repeated for every year until the probability of the life's continuance becomes indefinitely small, the sum of the results is the aggregate value of the expectancy.

But this sum demonstrably bears a constant relation to the value of the life, and is deducible from it, by multiplying the value of the life increased by unity into one pound discounted for

a year, subtracting the value of the life from the quotient, and multiplying the remainder into the given sum: and if it be desired to convert the value so obtained into an annual premium, it is only necessary to divide it by the value of the life increased by unity: it is not, however, necessary to determine the entire value of the assurance, in order to ascertain the annual premium; for this last may be originally obtained from the value of the life, by dividing it by itself, plus unity, and subtracting the quotient from one pound, discounted for a year.

The values of deferred or limited life annuities, are included in those of absolute life annuities: thus, as the series composing the value of an annuity of the latter kind, represents distinctly the value of each year's payment, the first ten terms give the value of the first ten payments, or of a ten years' annuity, determinable with the life; and the remaining terms, the value of all the subsequent payments, or of an annuity on the given life, to commence after ten years; but in practice, this detailed operation is superseded by a rule for deriving a deferred annuity from a table of probabilities, and a common annuity table, by first assuming that the life attains the end of the deferred term, and taking the value of an annuity as it will be on such attainment, and then multiplying this value by the probability that the life will so

attain, and discounting the product for the term.

Having thus found the value of a deferred life annuity, it may be subtracted from that of an absolute annuity on the same life, and the remainder will exhibit the value of an annuity on the life, limited to the term by which the former annuity is deferred; that is, to end when it commences.

In like manner, the values of limited and deferred life assurances are included in the value of an absolute assurance, and may be easily ascertained from the values of limited or deferred life annuities; which, however, must be computed for the occasion, as no complete tables of them are published. The rule for a limited assurance is, to add unity to a limited annuity for one year less than the term, discount the sum for a year, and subtract a limited annuity for the term; and for a deferred assurance, to take an annuity deferred for one year less than the term, discount for a year, and subtract an annuity for the term.

When a payment or series of payments depends upon the joint continuance of more lives than one, we have two or more concurrent probabilities to attend to, instead of a single one; and therefore, in computing the value of an annuity on two, three, or more joint lives, the operation before described is varied, by sub-

stituting the product of the separate probabilities of life for the single probability; and always attending to this, the values of limited and deferred annuities, or assurances on joint lives, may be deduced from a table of annuities on joint lives, and a table of probabilities, by rules analogous to those applying to single lives.

The introduction, however, of more lives than one, gives rise to the most diversified questions upon the value of various interests depending on their duration or extinction; some simple enough, as the value of an annuity on the longest of two lives, either commencing immediately or at the death of the shortest, or the value of a corresponding assurance; some sufficiently complicated, as those depending on the order of survivorship among many lives. The instance I am about to give, is far from being an extreme case; indeed, it is literally a simple one, compared with some questions of survivorship where fewer lives are concerned.

To determine the value of an annuity on the surviving life out of six, commencing on the extinction of five, it is necessary to add together, first these values; namely, the sum of the six single lives, thrice the sum of the twenty possible combinations of three joint lives, and five times the sum of the six possible combinations of five joint lives: then these values; twice the sum of the fifteen possible combinations of two joint

lives, four times the sum of the fifteen possible combinations of four joint, and six times the value of the six joint lives, and to subtract the latter from the former. For this operation we should have to extract sixty-three different values from the Tables, if Tables there were which would furnish them all; but such do not exist.

CHAPTER II.

GENERAL EXPLANATION OF THE STATISTICAL DEPARTMENT OF THE SCIENCE, AND ITS CONNEXION WITH THE SUBJECT OF POPULATION.

THE problems which have been already adduced, are abundantly sufficient to illustrate the importance of the statistical department of the science, which we are next to consider, for they all assume the probabilities of life to be previously ascertained, and their correctness and utility rest entirely on this assumption; but the original determination of these probabilities, depends on extensive and minute observation of the actual rate of mortality in the human race; and I shall proceed to describe the principle on which this observation is founded, the manner in which it is instituted, and the defects to which it is incident.

It is evident, that in a population kept stationary by equality of births and deaths, and undisturbed by migration, the average number

dying at any particular age, must always be the same from year to year, unless the law of mortality itself vary, which is not to be presumed without proof. These numbers, then, being ascertained, will represent the proportions into which the mass of deaths may be constantly distributed from year to year, from generation to generation; and therefore, as the slightest attention to the doctrine of chances shows, the proportion which the number dying in any one year after a given age, bears to the sum of all the deaths after that age, will express the probability that a person of that age will die in that particular year; that is, it will express the proportion which such probability bears to the certainty of his dying some time or other; so the sum of deaths in any selected number of years, will denote the relative probability of the life dropping within such selected years.

Taking, therefore, the sum of all the deaths above the given age for a denominator, and the number of deaths in the first year after the given age for a numerator, the fraction expresses the chance of the life dropping in the first year; and the complement of this fraction, or the fraction having the sum of all the deaths for its numerator, shows the chance of the life's failing in some subsequent year; that is, of its continuing to the end of the first year.

Proceeding on this principle, the numbers

dying at each age, within a moderate period of years, are extracted from the burial registers of the place whose law of mortality is sought, and a table is constructed, in which it is for convenience assumed, that a number of births, equal to the total of deaths in question, takes place at the same point of time, and this number is laid down as a radix, or original stock. The number ascertained to die in the first year, is then put down in another column, as the decrement for that year, and the remainder set down to the age of one year, as the number living to attain one year; the deaths in the second year then take their place in the column of decrements, and the reduced remainder denotes the number attaining two years; and this operation is continued until the last ascertained age is reached, and the number of living finally exhausted.

In such a table, the probability of any given life surviving any given term, or failing in it, may be readily found, as will be evident from what has been said; and by substituting for the true numbers a proportionate series, the table may be accommodated to any radix. Hence arise two problems; namely, to compute the population of a place from its table of mortality, and to determine the expectations of life from such table.

As the number taken for the original radix

denotes the actual number of annual births in the supposed place, it would seem, at first, that the number in the table attaining the age of one, would denote the number of that age actually living at the place out of the births of the past year; and the number in the table attaining two, the actual number of that age living out of the births of the preceding year, and so on; but it must be considered, that, though in the table the births of each year are supposed to take place at the same time, they are in fact distributed, as are also the deaths, over the different parts of the year, at different intervals, which may, for the purpose of the present question, be presumed equal.

The number, then, actually living of the age of one, includes all between one and two, of which the proportion approaching two has been reduced by the mortality of the second year, and the intermediate proportions by the mortality of their respective fractional parts of a year, so that one-half of the second year's average mortality may be assumed to have operated on the mass, and the number attaining one in the table must therefore be corrected, by the deduction of half the current year's decrement, or in other words, the number required may be considered as an average mass of a year and a half old, and will therefore be a medium between the attaining numbers at one and two.

It is obvious, that a similar correction must be applied to each age, which being done, the number attaining any age in the table, less half the next decrement, will represent the actual number of that age living, and the sum of these numbers will give the actual number of the living at all ages; namely, the population: these numbers may be conveniently deduced from those of the table, by appropriating a column for them.

The expectation of life, is a term frequently used without a proper understanding of its meaning; it is popularly supposed to express, the period for which a man may rationally expect to live, whereas it very seldom coincides with it. A man may very rationally expect to live to that term which he has an equal chance of attaining, or at which the number of his contemporaries will be reduced to one-half; but this expectation, or the average duration of lives of his standing, may differ widely from such term, and is, in fact, found to exceed it almost universally; the reason is, that the lives of some among the latter half will probably exceed the period of equal division, much more than any of the former half fall short of it, thus enhancing the average duration of lives of the given age, which is properly enough termed the expectation.

If the commencement of life, or any year of

it, be taken, the fraction denoting the probability of living one year would be the expectation for that year, or the space which those who enter together collectively enjoy of it, provided the decrement took place at the commencement; but as it is really distributed through the different months, it may be generally assumed, without material error, that each of the persons dying within the year, enjoys, on an average, one-half of it, so that one-half of the proportion of deaths, or in other words, the probability of death during the year, must be added as a correction; and, as the same reasoning holds good of each succeeding year, it follows universally, that, at any age whatever, the expectation of life is, for the first year, the probability of life plus half the probability of death; for any term of years, the sum of the successive probabilities of life plus half the sum of the successive probabilities of death; and for the whole of life, the sum of all the probabilities of life plus half the aggregate probabilities of death; that is, half unity, which last expectation may be compendiously determined, by dividing the sum of all the different numbers attaining the successive years subsequent to the given age, by the number attaining the given age, and adding half unity to the quotient, or by dividing the sum of all the numbers living at and above the given age, found as before directed, by the same divisor.

As the expectation, then, if the allowance of half unity be rejected, is the sum of the probabilities of life, it would clearly coincide with the value of an annuity on the life, if no interest were reckoned; and hence it may be supposed, that the value of a life annuity may be derived from the expectation, by taking the value of an annuity certain for an equal term; but such an approximation, if it deserves the name, is never to be depended on. It does not, perhaps, coincide with the true value in a single case, and the errors are often considerable in themselves, but fearfully magnified when derivative operations are attempted.

Among the defects of this mode of constructing Tables, the imperfection of registers may be noticed, though of but little consequence. It may be safely assumed, that, though they do not record all the burials, they represent the proportions truly, as the respective omissions may be presumed to be in the same ratio as the respective insertions; but to this presumption, one exception must be made. As the Church of England denies funeral rites to unbaptized infants, the parish registers do not include such infants, and, consequently, understate the number of deaths in infancy in a slight degree; criminals and suicides are registered, with an exception in each case, too rare however materially to affect an extensive average.

The increase or diminution of births, is a disturbing cause of far greater magnitude. It has been assumed hitherto, that the population has continued strictly stationary, the annual deaths and births being equal and invariable; but when this is not the case, an error is produced, and often a very material one. If, in the place where the observations are taken, the annual births one hundred years ago amounted to only one-half of what they now do, it is evident that a modern table, constructed as before explained, must represent the chance which an infant at birth has of attaining one hundred years, as less than it really is in the ratio of the former annual births to the present annual deaths, as the births one hundred years ago are the true radix, or denominator, with which the present deaths at the age of one hundred ought to be compared.

The correction of this error is simple in theory, though not always practically easy; namely, to determine the number of births in each past year during the life of the oldest person registered, and, by the rule of proportion, to equate the number attaining each age out of a given mass born in a given year, to the number which will hereafter attain the same age out of the present mass of annual births, and to substitute such equated numbers in the table.

Another cause of error, is the constant mi-

gration which is found to take place every where, particularly in towns. It is evident, that when there is a regular influx of strangers at a given age, the number of deaths after that age will be increased, and consequently, the proportion between such number and the number of previous deaths, will be disturbed; so that, in a table of mortality deduced from the burial registers, the probabilities for every age after the cessation of the influx will be true, but for every previous age will appear better than they ought.

If we suppose an emigration instead of an influx, the effect will be exactly reversed. Now, it is perhaps the most difficult problem connected with this part of the subject, to make due allowance for the variations thus caused.

Towns appear generally to receive an accession of males about the age of twenty, and for a few years after; of females earlier: but this depends much upon the prevailing employments in such towns; at a later period, it is probable that a secession takes place, in consequence of persons withdrawing from those active occupations of life which required their residence; and perhaps, at the more advanced periods of life, there is again a small influx; but the operation of these causes, is so different in different places, and so variable from time to time in the same place, that it is difficult to reduce it to calculation.

Besides, there is a probability that some of the emigrants may be exposed to dangers productive of a very different rate of mortality, and a just allowance should be made for these dangers, in philosophically determining the mortality of any place; for if there be a constant average number of emigrants who encounter these dangers, there is an assignable probability affecting every person from birth, that he will be one of the devoted few. This allowance in the case of females, would probably, if ascertained, be always inconsiderable, as comparatively few of them leave the country, and the difference of risk in the different parts of it may for the present purpose be disregarded. But it is otherwise with men; for the victims of the ocean, of climate, and of war, are numerous enough, both absolutely and relatively, to command the attention, though they may baffle the ingenuity, of the calculator.

In proof of this, it may be mentioned, that the British who perished in the engagements of the 16th and 18th of June, 1815, admitting that three-fourths of the wounded recovered, amounted to 4087, while the total number who died in the same year in Great Britain and Ireland, between the ages of twenty and fifty, according to the Northampton Table of probabilities, fell short of 6500, and perhaps did not in reality reach five thousand.

A regular determination of this allowance has not, to my knowledge, been even attempted; and the correction for migration, independently of such allowance, can only be accomplished by estimation, which must be in a great measure conjectural, and can only be depended on as an approximation: such is the case with the London and Northampton Tables, adopted by Mr. Simpson and Dr. Price.

Another source of error may be found in the possibility of the rate of mortality actually varying from time to time, co-operating with or counteracting a variation in the number of births. Some remarks on this head will be offered hereafter; in the mean time, its bearing on the present part of the subject cannot but be sufficiently obvious.

In the accompanying Tables, I have not offered any correction of these irregularities; there can, however, be little doubt that such a correction would have materially improved the probabilities of life; (excepting those exhibited in Table VI. as prevailing in the Society of Friends, which, for reasons hereafter stated, may be considered as a near approximation to the truth;) but they were sufficiently satisfactory for the immediate object, though they would be unsuitable to found tables of annuities upon for general use.

Mr. Milne, the present Actuary of the Sun

Assurance Office, points out a mode of determining the law of mortality, which is in a great measure free from the operation of the disturbing causes, and proceeds on the principle, that, however they may increase or diminish the deaths at any age, still these deaths are produced by the actual population of that age, and consequently bear the true ratio to the number living at that age. By taking, therefore, the average annual deaths at each age for a moderate term of years, and comparing them with the numbers living at each age in the middle year of the term, ascertained by actual enumeration, the ratios of the decrements to the numbers living at every age will be determined; whence a table of probabilities may be easily constructed, taking a radix at pleasure.

This mode pre-supposes that the population is either stationary, or increasing or decreasing uniformly during the term; and that there are no deaths but what the registers exhibit. However these suppositions may vary from the fact, still, the resulting errors will in most cases be trifling, compared with those tables derived from burial registers only.

CHAPTER III.

HISTORICAL SKETCH OF THE ORIGIN, PROGRESS, AND PRESENT STATE OF THE SCIENCE IN GENERAL.

THE history of the science is completely modern. In the "Natural and Political Observations on the Bills of Mortality," published by Captain Graunt, in 1670, is a table of mortality, founded on the assumptions, that thirty-six per cent. of the born die before the age of six, and that the remainder diminish in a geometrical ratio, until seventy-six, when only one survives out of the hundred, and that this one dies before eighty; considering, of course, all those attaining a greater age as extraordinary cases, and exceptions to the general law of nature's limit: but the bearing of the rate of mortality on the value of annuities, does not seem to have occurred to the Author.

From this quaint tract, we learn that it was

the vulgar belief, that London contained two millions at least; that there were three females to one male; and that it was an even chance that a man, meaning apparently a middle aged man, lived ten years.

John de Witte, we are told by Montucla, published a Treatise on Life Annuities, in 1671, and his countryman and contemporary, Van Hudden, wrote on the subject; but it is doubtful whether either work is extant.

Struyck, who wrote at the distance of half a century, met with De Witte's work, and gives a favorable account of it; but Leibnitz sought in vain for a copy of it, and it seems to have been unknown to our countryman, Dr. Halley, whose paper in the philosophical transactions for 1693, may be considered the foundation of the science.

In this paper, the Doctor gives a table of mortality, founded on a register at Breslaw, and describes the mode of calculating the values of single and joint lives, and the longest of two lives, and subjoins a table of the values of single lives; which seems to be the first ever calculated from ascertained probabilities of life, as the Doctor, speaking of his Table of Observations, says, " It exhibits the number of people in the city of Breslaw at all ages, from the birth to extreme old age, and thereby shows the chances of mortality at all ages, and likewise how to

make a certain estimate of the value of annuities for lives, which hitherto has been only done by an imaginary valuation."

The Doctor complains much of the labor of computing annuity tables, and says, that he had in vain endeavored to abridge it. De Moivre, however, about thirty years afterwards, conceived the idea of shortening the process by reducing the rate of mortality to some uniform arithmetical law. For this purpose, he invented the famous Hypothesis which bears his name, of equal decrements, or diminution in arithmetical progression; assuming, that from the age of twelve, an equal number dies in every year until the end of the eighty-sixth year, when the whole number is extinct.

The age of eighty-six being thus supposed the limiting term of life, the space intervening between a given age and that term was called the complement, and the expectation was in all cases half the complement; by the use of the hypothesis for single lives, and of a still worse hypothesis, namely, diminution in geometrical progression, for joint lives, and various approximations which he derived, De Moivre boasted, that a man might do as much in a quarter of an hour, as he could otherwise do in a quarter of a year. Tables were constructed upon the hypothesis; its regularity and simplicity recommended it to theorists; and it be-

came, for a time, very generally received in practice.

The difficulty which De Moivre had attempted to evade, was fairly met and conquered by Thomas Simpson, who pointed out a method, by which a table of values for all ages may be constructed, with little more trouble than a single value for any one early age might be formerly determined. It consists in beginning with the oldest age in the table, and after determining its value, deducing from it the value of the next preceding age, by adding unity, discounting for a year, and multiplying by the one year's probability of life, or probabilities in the case of joint lives.

This plan, abbreviated by the use of logarithms, reduces the labour of calculating tables, (though perhaps it is still much underrated by those who have never attempted it) in an important degree; and its simplicity does not diminish its merit, for it should be remembered that it escaped the great Halley, and for some time, the greater Euler.

Simpson calculated and published tables of the values of single and joint lives, from a table of probabilities founded on the London bills of mortality, now ascertained to vary materially from the true ratio prevailing among mankind at large. Hence, his tables are useless at present; but he brought the mathematical part of

the science to a state which received little or no improvement, until the labours of Mr. Morgan.

Deparcieux, in 1746, enriched the science with tables of mortality, founded on the registers of various religious houses in Paris, and a register of tontine annuitants in the same city.

These tables probably approach more nearly to the actual rate of mortality among mankind than any ever published, not excepting the Carlisle Table, (of which more hereafter;) but in other respects, the work appears to have been much inferior to Mr. Simpson's. I cannot, however, speak from personal knowledge, having never seen a copy, but judge from the little notice it has attracted.

Dr. Price's work was published in 1769, and by treating the subject in a plain and familiar way, by exposing the delusion and insufficiency of various schemes in his day, and by exciting a spirit of investigation and a love of practical accuracy, it has been, if not the most able, the most useful book that has ever appeared on the subject. He at first made use of De Moivre's Hypothesis, as did Mr. Morgan, in his first edition of his Doctrine of Annuities, published 1779; but in the course of time, Dr. Price discovered that the Hypothesis, when tried by the test of facts, was very defective, being often

unworthy of dependence, even in the case of single lives, and utterly unsuitable for more complex problems.

He resorted to the only satisfactory foundation, actual observation, and judging of various Tables, that the Northampton one was the most suitable for his purpose, he made some discretionary corrections in it, to counteract the disturbing causes before described; and, in conjunction with Mr. Morgan, calculated from it tables of the values of single and joint lives, which appeared in his fourth edition in 1783, and are generally recognized in practice, as the standard authority of the kingdom to this day.

In the same year, (1783,) the late venerable Baron Maseres published a Treatise on Annuities, with Tables of the Values of Single and Joint Lives, founded on Deparcieux's Table of Mortality. A great part of the book is occupied with the discussion of schemes for the reduction of the national debt, and for establishing annuity funds for the lower classes; but the elementary part, as a systematic, familiar, and copious exposition of the introductory part of the science, is, I believe, considered equal, if not superior to any thing that has ever been published.

The more recent edition of Dr. Price's and Mr. Morgan's works, have received great im-

provements from the hand of the latter gentleman, including several questions, which had been determined from the faulty Hypothesis of De Moivre, or approximated from the expectations of life, until Mr. Morgan communicated the true solutions to the Royal Society.

On the Continent, besides Deparcieux, St. Cyran, Florencourt, Euler, and Duvillard have at different times written on the subject; but (if it be permitted to speak at second hand of their merits,) they appear to be materially behind our countrymen.

Mr. Milne, to whose writings, in reference to many topics comprised in this Treatise, I confess my obligations, has, in his late Treatise on the Valuation of Annuities, and Assurances on Lives and Survivorships, surpassed all previous writers in the extent of his investigations, and the mathematical connexion in which he has arranged them; preserving the chain of demonstration throughout, and giving general solutions wherever particular questions are reducible to a comprehensive class. The greater part of the work, however, is addressed to the scientific reader only, and is neither designed nor suited for popularity.

Mr. Milne may be said to have exhausted the subject as far as three lives are concerned; but remarks, that it is useless to treat of a

greater number, there being no tables of the value of four joint lives in existence, and no probability of any being published; nor was there at the time any probability of it, but a prospect has since opened of our having this, and still greater scientific deficiencies supplied, by the extraordinary invention of Mr. Babbage,* which promises to extend the power of calculation (by machinery,) in a greater degree than any improvement since the invention of logarithms.

The tables of the values of lives which have been published are very numerous, but comprehend no great variety of subjects; and their number is no advantage, as out of many counterparts, (tables of the value of single lives for instance,) the one of the greatest

* An account of this surprising and ingenious machine is published in the Philosophical Magazine for May, 1824, Vol. III. p. 355. It has been recently announced, in the public prints, that it continues in active and steady progress, but that such is its extent, such the variety of mechanical movements to be contrived and executed, and such the elaborate perfection of workmanship which it has been found necessary to bestow on all its parts, to afford a moral security for its successful action when put together, that a very long time must yet elapse, and a very heavy further expense be incurred, before it can be completed, but that no suspicion of a failure has yet arisen; on the contrary, that every mechanical difficulty has been completely overcome, nor has any obstacle occurred in the slightest degree calculated to raise a doubt as to its ultimate success.

authority supersedes all the rest, which become objects of curiosity only, not of use.

Scarcely any tables but those founded on the Northampton probabilities, and used by the Equitable Office, are ever resorted to in England, with the exception of some adopted by particular offices, and whose use is confined to such offices, among which it is apprehended Mr. Milne's, or a modification of them, must be included.

The Northampton collection, which is much more complete than any earlier one, contains, as exhibited in the later editions of Dr. Price's work, the following tables:—

Annuities on single lives, at six different rates of interest.

Annuities on two joint lives, for all ages up to seventy, differing by five years or any multiple of five, or are equal, at four rates of interest.

Annuities limited for one, two, three, five, or seven years, for every fifth year of age from ten to sixty-five, at 3 per cent.

The values of survivorship assurances and annuities, in single payments and annual premiums, on the same scale and at the same rate.

Annuities on three equal joint lives, and on three joint lives differing by ten and twenty years, at 4 per cent.

The single values and annual premiums of absolute assurances on joint lives, whose ages are divisible by five, from ten to sixty-five years of age, at 3 per cent.

Mr. Milne's collection, founded on the Carlisle tables of probabilities, and published in his work, contains,

Annuities on single and joint lives, similar to Dr. Price's as to the scale and rates of interest, except that the Doctor's tables of joint lives omit infancy and old age, which Mr. Milne's include.

Annuities on two joint lives for all ages, differing either by seven, thirty-two, or fifty-seven years, at 5 per cent. And

Annuities on three equal joint lives, and on three joint lives differing by five and twenty-five years, at 5 per cent.

Besides these, the Prospectus of the Sun Office contains, as does that of the Equitable,—

A table of premiums of assurance, either absolute or limited, for one or seven years, for every age from eight to seventy.

A table of premiums of assurance for joint lives whose ages are divisible by five. And,

A table of premiums of survivorship assurances, for ages divisible by ten. All these tables are calculated at 3 per cent; the reader, however, is referred to some

observations on them, annexed to Table VII. in the Appendix.

It will thus be seen, that, in the best collections of tables which we possess, there are many desiderata; among the most material may be named the following:—

1. A complete table of limited annuities for single lives.
2. An abridged table of the same kind, for two joint lives.
3. A table of the values of three joint lives, for all ages, divisible by five.
4. A table of assurances for single lives, in entire payments; complete as to absolute, and copious as to limited assurances.
5. A table of premiums for limited assurances of single lives, comprising every term under twenty-one years. And,
6. A table of the values of absolute single life policies, after any duration.

A complete table of the values of all combinations of two joint lives is still more wanted. Dr. Price's book informs us that the Equitable Office possesses such a table, but it remains to be published.

The values of all combinations of joint lives, according to the Northampton table, are given in the tables subjoined to the legacy duty Act; but, as they are calculated at 4 per cent. interest, their utility for general purposes is not

considerable. It is much to be desired, that separate tables for males and females should be provided, and used in all cases, as the probabilities differ materially; and that all tables should be carried to four places of decimals.*

* When a standard table of probabilities for the whole kingdom shall have been accomplished, the desiderata here noticed will doubtless soon be supplied. The terms of the respective Offices for life assurances and annuities will then become more uniform.

CHAPTER IV.

PRESENT STATE OF THE STATISTICAL DEPARTMENT OF THE SCIENCE IN PARTICULAR.

UNTIL some scale of mortality is generally acquiesced in, as the standard, there is little encouragement to any person to calculate or publish new Tables; for they may at any time be superseded by others founded on a more approved rate of mortality. It is therefore of importance, to review the present state of the statistical department of our science, by seeing what materials we have accumulated; what prospect they offer of the establishment of a received canon of mortality; and what means are most likely to conduce to the attainment of this object.

The principal tables of mortality which we possess are,

Dr. Halley's, from the Breslaw register.

Smart's, corrected by Simpson, from the London registers.

Kerseboom's, from a register of the Government annuitants in Holland.

Duprè de St. Marn's, from three Parisian, and twelve provincial parish registers combined.

Deparcieux's, from the registers of the French tontines, and of five religious orders in Paris, classified.

Mr. Brakenridge's, from the London bills of mortality.

Dr. Price's, from the mortality bills of Northampton, Norwich, and London.

Dr. Aikin's, from the registers at Warrington.

Mr. Gersuck's, from the register of Holy Cross, near Shrewsbury.

Dr. Haygarth's, from the Chester registers.

Muret's, for the Pays de Vaud, Switzerland.

Mourguet's, from Montpelier.

Duvillard's, intended for the Kingdom of France in general, but not properly explained as to its actual composition.

Susmilch's, compiled from his voluminous collection of observations at various places.

Wargentin's, and Nicander's, from the official Swedish census. And,

Mr. Milne's, for Carlisle, deduced with great

care and precision from data furnished by Dr. Heysham.

As Mr. Milne observes, none but Deparcieux's, the Swedish, and the Carlisle observations, and possibly Kerseboom's, (of which, however, we have not such information as to warrant entire confidence,) give satisfactory data, for none but the Swedish and Carlisle tables give enumerations, so as to furnish a correction for the errors caused by migration and increase of population; and none but Deparcieux's, (and *apparently* Kerseboom's,) identify the persons so as wholly to obviate these errors; yet, of these authorities, three represent the mortality of foreigners; and, of these, two were composed from select classes, and the other from the inhabitants of an inclement region; the fourth rests upon the experience of a single small city, in a corner of England: it may, by possibility, coincide with the average mortality of the kindgom, though it is highly improbable, as will be shown hereafter; but it certainly is not so fit for a standard authority, as the results of a more extended observation would be.

In commenting on the curious and interesting information, furnished by the parliamentary enumerations of 1801 and 1811, Mr. Milne pointed out the desirableness of procuring a return of ages as well as inhabitants, in the next census; and it was probably in some measure in con-

sequence of this judicious suggestion, that in the census of 1821, the officers were furnished with printed papers, enquiring the ages of the residents. As, however, the distribution of these was optional with the officers, many places, containing together about one-eighth of the population of Great Britain, made no return of ages; * and only one such return was furnished by the City of Bristol; namely, by the parish of St. Philip and Jacob. This I particularly regret, as such returns would have shown a greater alacrity in my fellow-citizens, in forwarding the reasonable wishes of the Government, and probably would have afforded us interesting materials for comparison on the present occasion. In Barton Regis, Clifton, Mangotsfield, and St. James, (out) were the only parishes which furnished such returns.

The tables of ages, printed with the population returns of 1821, constituted a valuable acquisition to our knowledge on this subject. The limits of this Treatise will not admit of a detailed notice of the phenomena which they present; I must therefore refer to the documents themselves, requesting particularly, that

* Out of the population of Great Britain in 1821; namely, 14,391,631, the ages of 1,904,254 were omitted. Much greater attention was paid in Ireland to this important object; for out of a population of upwards of 6,000,000, the ages of only 8,397 were omitted.

the fluctuation of the population of our vast metropolis, as exhibited by the County of Middlesex, may be noticed: it will serve as an extreme case, to elucidate the impropriety of taking tables deduced from the registers of large towns, as a specimen of the country in general.

The most satisfactory and authoritative table of mortality, would evidently be, one actually compiled from observations extending to the whole population of the country; and the best means of compiling and verifying such a table, would be, by taking the results of a general registry of births and deaths, and comparing them with the enumerations and returns of ages under the population act.

The baptisms and burials which the parish registers record, are known to be much inferior to the number of births and deaths which the kingdom furnishes; but the amount of the deficiency is quite unascertained, and so vaguely conjectured that I will not hazard an estimate; I will barely mention, that if the sum of registered baptisms from 1801 to 1810 inclusive, according to the parliamentary returns, be added to the resident population of 1801, and the sum of the registered burials during the same period be deducted, the result will fall short of the ascertained resident population of 1811 by 348,918; though the number employed in naval and mi-

litary occupations had been greatly increased out of the former population, and the multitudes who perished by the sea and the sword in the interval, replaced.

The plan of a general registry, was in the year 1824 brought before the House of Commons by a Mr. Kemp, but was not matured. If such a measure could be accomplished without any burdensome regulations, it would be an important benefit to the country in other respects than that of science: it is to be hoped, therefore, that the suggestion of Mr. Kemp will be renewed in parliament, and the measure be adopted by the legislature.

I cannot close this chapter more appropriately than with the following sensible remarks in the Edinburgh Review of March 1829, which bear immediately on the subject before us:—

"A census, in which the occupation of every individual, and his age were specified, would be a most valuable document; not only would it show the number of individuals belonging to each separate profession, but it would serve to exhibit the influence which different employments exercise on the rate of mortality; while, by comparing different censuses of this sort, future enquirers would obtain an accurate knowledge of the changes produced by the progress of society, both as respects the numerical relations of the different classes with each other, and as

respects their longevity. Legislators and practical men would thus be furnished with additional means of perfecting their theories and plans; and philosophers would be enabled to clear up and decide many controverted and difficult questions, some of which hinge upon points of practical importance; inasmuch as they would have it in their power to appeal to facts and experience, where we can do little more than build upon hypothesis and conjecture.

"Had accurately classified censuses been taken every ten years, from the accession of his late Majesty, what a flood of light would they have thrown on many most interesting subjects! They would have enabled us to trace the various fluctuations of industry, the rise and extension of some classes, and the decline and extinction of others; and by comparing the ages of those engaged in different occupations, at different periods, we should have learned what had been the average healthiness of each, and which consequently had gained most; for they have all gained something, though not equally, in the common progress.

"Let not therefore the approaching opportunity of obtaining a correct census, a census worthy of the country and the age, be neglected. If the census to be taken in 1831, be executed with due care, both as respects the enumeration

and classification of the people, it will be one of the most important documents ever prepared under parliamentary authority; and will not only afford a vast deal of information of immediate practical utility, but will be a point of comparison to all future times."

CHAPTER V.

REMARKS ON THE PRACTICAL APPLICATION OF THE SCIENCE.

THE application of the science has created Institutions, whose number and magnitude irresistibly claim our attention.

Of Life Assurance Offices, the oldest is the Amicable, which was instituted in the year 1706, when the science could hardly be said to exist; and the plan of the office was in consequence grossly defective, the contributions being equal for all ages between twelve and forty-five, and each year's income being wholly divided among the claimants of that year: it nevertheless escaped destruction, and when the subject became better understood, was remodelled: its constitution received successive improvements, and it still exists and flourishes.

The Equitable office is perhaps the most extraordinary creation of unpatronized individuals which the country can boast. A plain corner house,* near the foot of Blackfriar's bridge, is the seat of an establishment, whose income exceeds that of many sovereign princes of Europe; whose investments are counted by millions; on which thousands of families hourly depend for preservation from indigence; and which commenced on a very small scale not seventy years ago.

In 1761, the Equitable office was founded: through the excellence of its plan, the prudence of its management, and the deservedly high character of its actuary, Mr. Dodson, and his successor, Mr. Morgan, its business progressively increased, until the year 1816, when a constitution less advantageous to the public was adopted, with the singular, but avowed design, of discouraging the overwhelming accession. The experience of this office has been sufficient to ascertain a regular rate of mortality among the members, varying from the common rate, by exhibiting a longer duration of life.

Since the foundation of the Equitable, several assurance offices have sprung up, showing, that as demand is generally the cause of supply, so

* This *rara avis* is no more—an edifice more suited to the magnitude of the transactions carried on, and to the extended views of the present day, has recently, like the Phœnix, risen from the ashes of its predecessor.

supply not unfrequently produces demand, by the attention which competition attracts, and the facilities it offers to the public at their just value: about thirty* such offices exist in London, of which, after those mentioned, the Sun, the Provident, and the Rock may be considered at the head.

Out of the system of life assurance, has arisen the practice of raising money on annuity, in which the borrower grants an annuity on a given life equal to the interest and the premium of assurance on the life; and thus the lender secures his principal, receiving, in the mean time, whatsoever interest the borrower may choose to submit to.

Though the usury laws are virtually repealed by this practice, it has prevailed and continues to prevail to such an enormous extent, that the legislature, deeming it impossible or impolitic to suppress it, has merely imposed certain regulations to ensure the publicity of such transactions: many life assurance offices employ part of their capital in the purchase of such annuities, taking the risk wholly or partially upon themselves.

* Nearly one-third of this number have started into existence within the last five or six years, most of which were generated at the period of the Joint Stock Company mania; while a few others, as well in the country as in London, hardly survived their birth.

Institutions for the endowment of widows and children are still numerous, though generally on a limited scale: the principal life assurance offices, however, by granting endowments themselves, in addition to their other business, circumscribe the operations, and in a great measure supersede the necessity, of separate institutions.

The popularity of various concerns of this kind, established on fallacious principles, was the cause of Dr. Price's drawing the public attention to the subject; and showing forcibly the danger of adopting any basis not sanctioned by scientific calculation: his predictions were verified by the ruin of the schemes whose conductors rejected his admonition, and his work now preserves their names from oblivion; but there can be no doubt, that, even at present, many minor establishments exist, which time will prove to have benefited early participants at the expense of future sufferers.

Benefit societies nearly resemble, on a small scale, the last mentioned institutions; their number is almost incalculable, and their efficacy in diminishing the sufferings of the poor, is upon the whole great, notwithstanding their generally bad constitution, and equally bad management, which their short existence almost invariably testifies.

The influence of the higher classes, when employed in organizing and controlling these

institutions, is well bestowed; certainly much better than the well meant but ill judged donations sometimes made to them, which, constituting a sort of eleemosynary bonus, tend to make mean cupidity the motive of an act, which would otherwise spring from, and be constantly associated with, feelings of economy and independence.

Instances may be given, in which the legislature of this country has availed itself of the science which we are considering; the valuation of the duties under the Legacy Act, has been already mentioned; annuity creditors are, by a late bankrupt act, directed to prove the value of their annuity, estimated with reference to the original purchase money, by allowing for depreciation in the life, which, of course, can only be done by consulting an annuity table. The Act does not prescribe any table in particular, and consequently the Commissioners are at liberty to use the Northampton or the Carlisle tables, according as they happen to be disciples of Mr. Morgan or Mr. Milne.

The plan of granting life annuities towards the reduction of the national debt, is another and a more important instance; it cannot, however, for a reason which will be noticed hereafter, be considered either a very judicious or successful measure in any point of view but one; namely, that of obliging the nation to ex-

tinguish a certain portion of the debt, which it would otherwise have merely the power and choice of redeeming, and by consequence, most probably, of not redeeming.*

* The Finance Committee discovered the inexpediency of this measure, as respected the terms on which annuities had been granted, and exposed the great disadvantage accruing to the public, (which was most absurdly exaggerated by some members of parliament, ignorant of the subject:) in consequence, the power of the commissioners to grant annuities was suspended, and fresh powers were given, by an Act passed last session, to grant annuities conformably with corrected tables of the values of lives, founded, as common sense would advise, on the rate of mortality among select lives; namely, annuitants, tontine nominees, and such like.

The original Act establishing the measure, passed in the 48th year of George III.; in the 49th another Act passed, amending the former; in the 52d another Act, amending the two former; in the 56th another, amending the three former; and in the 57th another, amending all the preceding four. Notwithstanding the subject was so repeatedly brought under the notice of the legislature, it was left for the finance committee to discover the mischievous consequences of a measure, which ignorance or wilfulness almost incredible had so long persevered in.

While, however, the corrected values of the government annuities are a security against any material public loss, the measure itself, as one of beneficial finance, may be unhesitatingly pronounced nugatory; for it has been already shown, that an annuity and its present value are mathematical equivalents, and the object of the government in revising the tables, was to make them so, as nearly as the value of contingent circumstances could, from past experience, be estimated; therefore, putting out of the question all fortuitous occurrences which might influence the result, and which are more likely to be favorable to the annuitants than otherwise, the correct

The plan of raising money by tontine, is in some respects similar to the foregoing, but rather more advantageous to the government, inasmuch as, instead of giving a calculated equivalent, as in the preceding case, the benefit of survivorship held out to the participants is a temptation in the nature of a lottery prize, for which the government is supposed to be paid in the terms of the bargain.

Thus Mr. Pitt calculated, that out of the million raised by the tontine, or rather tontines,* of 1789, two hundred and fifty thousand pounds

conclusion must be that the annuitant, the annuity, and the sum paid for it, will all expire at the same period of time; but, in reference to the national debt, it is a measure which, if carried to any extent, can only lead to embarrassment. For instance, if a quarter of the debt was immediately cancelled by being converted into annuities averaging seven per cent. it would require a loan of seven millions, in addition to the seven millions hitherto applied to the payment of the dividends, but now appropriated to the payment of the annuities, to pay the annuitants their first year's annuity, less the annuities which might chance to cease the first year; a similar sum, less the annuities which chanced to cease the second year, and so on, thus creating a new debt equal to the amount cancelled, or, which is the same thing, incurring an equivalent engagement. That private companies, however, may derive profit by trafficking in the sale and purchase of annuities, must, from circumstances which cannot be made available by a government only selling annuities at their precise values, be obvious to every one.

* The nominees were divided into classes, according to their ages; each class commencing with a different rate of interest on their respective subscriptions.

was profit. The tontines, however, have not turned out very satisfactorily to either party; for the great body of lives have lasted too long to suit the interests, either of the government or of the survivors: the latter receive their scanty dividends with little satisfaction, and the former have declined repeating the experiment when most pressed for money.

An extensive operation, in some respects the reverse of the preceding ones, was attempted by the government some years ago, when they proposed to grant a fixed annuity for the term of forty-five years, to any company who would take on themselves the payment of certain pensions; * which was in effect offering to purchase a number of life annuities, and pay for them by instalments.

As no company was willing to undertake the bargain, it was fictitiously effected by appointing a body of trustees, who carry it into execution at the expense and risk of government; that is, the government through the trustees, applies the fixed annuity in part payment of the pensions, and borrows to pay the deficiency; and this plan is to last until the pensions are reduced by deaths below the fixed annuity, when the savings are to be applied to the repayment of the money borrowed.

* Commonly called the dead weight.

CHAPTER VI.

PARTICULAR PHENOMENA IN THE DECREMENTS FROM WHICH THE ACCOMPANYING TABLES ARE CONSTRUCTED; WITH OBSERVATIONS ON THE GENERAL PHENOMENA OF THE SCIENCE, AND ITS CONNEXION WITH SOME OTHER BRANCHES OF OUR KNOWLEDGE, AND OBJECTS OF OUR INTEREST.

THOUGH it may reasonably be expected, and is found to be a fact, that after the periods of infancy, the risks of mortality vary very little in consecutive years, yet the results of limited observation must often show considerable accidental irregularities.

This was found to be the case in the registered burials when extracted by me, and arranged according to the respective ages. These irregularities I equated in forming the tables of

probabilities, by taking the average of three years for the middle year, and in a few instances making a discretionary allowance for a great and apparently casual irregularity. There is, however, one consistent phenomenon in these irregularities; namely, a great excess in the deaths at every decimal year in the advanced periods of life.*

It may be asked what solution I can offer of so remarkable a phenomenon; and I must freely confess, that I cannot entirely satisfy myself on the point, but am disposed to attribute the fact, partly to the mental depression with which invalids may regard the commencement of a more advanced epoch of life, and which may unfavourably affect their declining health; and partly to the uncertainty which the friends of the deceased may entertain respecting the exact age, and which may cause them to assign round numbers for want of precise information.

The first explanation supposes that the excess of deaths is real; the latter, that it is only apparent: the truth may probably lie somewhere between. I am not aware, however, that this phenomenon has been noticed in other registers, which might certainly have been expected, if the causes which I have suggested be the true

* See Observations on Table II. in the Appendix, where the comparative numbers are given.

ones, for they are not more likely to operate in Bristol than elsewhere.

Various cemeteries in Bristol, the property of undertakers and others, where only the lower class are interred, enabled me to compile a separate table of probabilities among the poor, which will be found to exhibit a much higher rate of mortality than the average; while the influence of temperance and other moral habits on longevity, is strikingly manifested in the table of probabilities among the Society of Friends.

The parish of Clifton will be seen to justify its character for salubrity by its table of mortality, when strangers are excluded: the accustomed resort of invalids must always prove the grave of many of them; and of course, these deaths cannot with propriety enter into the account of the mortality of the inhabitants.

I have recently found that the Philosophical Transactions for 1753, Vol. 48, page 217, contain the results of a summation of burials in Bristol, from 1741 to 1750, compiled by a Mr. Browning, from the registers of the seventeen parishes, and the Society of Friends, Baptists, and Jews, including the whole of such parishes as extend beyond the city.

The total number of burials in ten years is 17,317, whence, by assuming the annual deaths to average one twenty-fifth of the population,

Mr. Browning estimates the total population at 43,275. He comes nearly to the same conclusion by taking the number of houses rated to the land tax, (4,866,) adding one-fourth for omissions, and 1,228 for the out parishes, and multiplying the total (7,282) by six, the supposed number of inhabitants in each house, which gives a population of 43,692; but such a vague estimate is entitled to little confidence.

When we look at the principal general phenomena which the science presents, one of the most striking is, the superiority of the probabilities of life among females to those which males enjoy: this superiority obtains in a greater or less degree at all ages, even from birth, but is very conspicuous in the after stages of life. Hence arises the well known fact, that, though there are more males than females born, the number of females at all ages living at any given period, exceeds that of the living males.

The most obvious causes are, the comparative security of the female sex from many hazards and hardships to which the active occupations of men subject them, and the greater temperance which they practise: but it is possible that the male constitution may be originally more susceptible of disease than the female, for the mortality is greater even in the earliest periods of infancy.

It should always be remembered, that the apparent mortality of a town or a kingdom is substantially the mortality of the lower class, whose number so greatly preponderates that they always decide the average. In proof of this, it is enough to mention that Mr. Colquhoun makes the families of his sixth and seventh classes, together with the army and navy, (exclusive of commissioned officers) three-fourths of the whole population.

The average duration of life among the higher classes, is, in fact, decidedly superior to that of the lower classes; and this sufficiently disproves the notion which some entertain, respecting the recompense which the poor are supposed to have for their toils and privations, in superior health and hardihood; few persons, however, on reflection, can, in the present day, retain such opinions.

A due consideration of the frequent scarcity, and occasional want of the common necessaries of life, which many of our humbler fellow-creatures experience; of the absence of that mental and moral cultivation, which, by controlling and regulating the passions, contributes to the length of life as certainly as to its happiness; of the prejudice and obstinacy which often debar them from the full benefit of medical assistance; (though to the honour of the profession it is placed within the reach of

the poorest;) and of the numberless occupations in which life is risked, (in some of which it is but too certainly forfeited,) will dispose us to admit, *a priori*, that the peculiar dangers of the rich cannot be compared with those of the poor.

But we have experimental proof of the fact, in the high rate of the Equitable probabilities of life, which cannot be adequately accounted for but by the respectable rank of the bulk of the persons whose lives are insured. It may be said, that these lives are selected; but, on the other hand, interested persons are constantly endeavouring to introduce bad lives, and notwithstanding all possible care, offices are thus sometimes imposed on; so that insured lives are not very materially better than promiscuous lives of the same class at first, and the lapse of a few years brings down this superiority, such as it is, to a mere trifle.

Deparcieux's tables of mortality among the monks and nuns, tend to corroberate the superior probabilities among persons above the lower ranks of society. Another independent, and to my mind decisive proof, is supplied by the table (III.) of probabilities among the poor, which exhibits a striking excess of mortality, when compared with the other tables, in which the higher classes, though still a minority, are included.

The disproportion of deaths in infancy, is, however, the most striking, and tells heavily in the estimation of the proportion of annual deaths to the number living, or the expectation of life at birth, which is the popular, though rather exceptionable criterion, of longevity in general.

It is most reasonable to suppose, that the probabilities of life among the highest classes of all, are, from obvious causes, inferior to those of the middle class, though superior to those of the poor; but this is not as yet regularly ascertained. As Mr. Milne justly enough observes, the determination of it would be of some importance to assurance offices.

It is a popular remark, that annuitants live longer than other people. The clerk of St. James' Chapel, Pentonville, observed to a relative of mine, who applied to him for an extract from the burial register, "I remember the woman well; she was upwards of ninety when she died; she was one of our chapel annuitants, for we wanted money some years back, and raised it by annuities, and we have observed that all our annuitants live to a good old age."

This notion of the superior longevity of annuitants, seems perfectly true to a certain extent, and is admitted by the able writer to whom I have more than once referred, who assigns what are without doubt the right causes,

namely, the selection of lives, and their comparative exemption from anxiety about the means of subsistence. Selection in this case must be infinitely more successful than in the case of assurances, because made by the very persons who are best informed, and are most interested about the soundness of the lives. This fact, and the superior probabilities among the higher classes, at once explain the duration of lives in the government annuities and tontines, and demonstrate the impolicy of raising money for the public service by such means.

There seems great reason to believe, that the probabilities, in general, of life, have improved during the last century; the annual proportion of deaths has been cited as a proof of this. For instance, in Mr. Rickman's Essay, prefixed to the Population Returns, it is remarked, that in 1780, the annual deaths were one in forty; in 1790, one in forty-five; in 1801, one in forty-seven; in 1811, one in fifty-two; and in 1821, one in fifty-eight.

But I have before said, that this is an unsatisfactory sort of proof: in strictness it is no proof at all, for a great and continued increase of births may increase the ratio of the population to the deaths, compatibly with stationary or even deteriorated probabilities of life; and if the increase of births be acknowledged insufficient to produce such an effect, the reduced

average only shows that there is an improvement somewhere.* It is most probable that the great

* These and other considerations, bearing upon this part of our subject, seem never to have occurred to the Author of "Medical Statistics," (recently published,) who, from the fallacies in the following extracts, it may be inferred, is but very slightly acquainted with the subject: they are inserted here with a view to counteract, as far as may be, their influence; for erroneous opinions, upon whatever subject, are prejudicial in some way or other; and the authority in this instance may be expected to be influential, the author, Dr. Hawkins, being, by right of *prescription*, the conservator of the human body.

"In Britain the value of life within the last eighty years is nearly doubled, comparing Busching's rate, viz. one in thirty-two, with the actual rate of 1821, one in sixty." "Pembrokeshire and Anglesey have only one (death) in eighty-three, which is the lowest *genuine rate of mortality* that has been published in any part of Europe."

"The decline in the mortality is more remarkable in our cities than in the rural districts: the change in the health of London will be seen in a powerful light, and this healthy condition has been produced within the last fifty or sixty years, the very period in which it has most rapidly enlarged its limits and population. In the middle of the last century the annual mortality was about one in twenty; it is now about one in forty; so that in the space of seventy years the chances of existence," (meaning the average duration of life,) "are exactly doubled, *which is a progress and final result without a parallel in the history of any other age or country.*"

"One CITY alone in Europe or in England approaches to London in the value of life proportionately to its size; it is the second *(city)* in England in number of inhabitants, the seat of manufactories—Manchester. The mortality there, was, about the middle of last century, one in twenty-five;" (observe, before it was such a manufacturing seat;) "in 1770,

diminution has been in infant deaths, which must have been materially reduced by the improved methods of treating children, and

it was one in twenty-eight; in 1811 the annual deaths are diminished, almost beyond belief, to one in seventy-four; but the improvement does not stop here, for, in 1821, they appear to become still fewer, *although the population has been quadrupled during the sixty years through which the deaths have so diminished.*"

"It is incontestable that Great Britain is at present the most healthy country with which we are acquainted, and this remarkable value of life extends to the man of affluence, the pauper patient of the Hospital, the sailor, the soldier, the prisoner of war, the inmate of a gaol! And we shall find, that notwithstanding the reproach heaped upon our climate, particularly the atmosphere of London, the places which have long been selected as the resort of invalids, and the fountains of health, are far more fatal to life than even this great metropolis." !!!

The brute creation also, we find from this work, participate in the blessings of superior health and strength, from the improved and improving salubrity of our climate. Well may the inhabitants of Manchester and the Metropolis, with the inmates of their gaols, hospitals, poor-houses, and manufactories rejoice, seeing that Hygeia has made London her town residence, and Manchester her country seat.

"There shall be no more thence an infant of days, nor "an old man that hath not filled his days; for the child "shall die an hundred years old."

Probably, in the opinion of the Doctor, this country is the new Jerusalem of the prophecy which is now accomplishing; at any rate he seems determined that the body shall keep pace with the mind in the rapid march of the present day: indeed it is but reasonable, that the latter should, in its improving career, be suitably lodged on its journey.

particularly, perhaps, by vaccination. Let it be remembered, however, that those who are thus saved from destruction in infancy, are subject to all the liabilities of after life, in common with their contemporaries, with the improvement of which, as far as we know, vaccination has nothing to do.

The efficacy of this discovery in preserving life, is strikingly shown by the London Bills of Mortality. A writer in the Edinburgh Medical Journal, for July, 1819, justly urges the fact, that, in twenty years before the introduction of vac-vaccination, namely, 1779 to 1798, the deaths by small pox, in the London Bills, were thirty-six thousand one hundred and eighty-nine, and in the following twenty years, ending 1818, only twenty-two thousand four hundred and eighty. But on examination, this statement, forcible as it is, will be found to give an imperfect notion of the present annual saving of life; for, throughout the second period, the prevalence of vaccination was progressive.

In the first ten years, ending 1808, the deaths by small pox were thirteen thousand six hundred and ninety-five; or, when compared with the whole number of deaths in the Bills, seventy-two in a thousand; in the next five years, five thousand two hundred and ninety-seven, being fifty-nine in the thousand; and, in the last five years, three thousand four

hundred and eighty-eight, or, thirty-five in the thousand. The experience of the country would probably be still more satisfactory than that of London.*

But, as far as we can judge, the probabilities of life at all ages have improved as well as of infancy, though in a less degree; the imperfection of the early tables prevents us from determining correctly the extent of this improvement, but they seem sufficiently to establish its reality.

Satisfactory causes may be assigned for this improvement; the principal appear to be, the generally increased temperance; the multiplied institutions for relieving the necessities and maladies of the poorer classes; the draining of fens; the improvements in our towns, particularly as respects the widening and cleansing of the streets; the removal of nuisances, and the supply of good

* In Sweden, where vaccination is enforced by the government, the deaths by small-pox were, in 1779, fifteen thousand; in 1784, twelve thousand; in 1800, twelve thousand eight hundred; in 1801, six thousand; in 1822, only eleven; and in 1823, thirty-seven.

There has been much controversy respecting the efficiency of vaccination as a preventive of small-pox, and as some cases have occurred which weaken its claim to infallibility, and some prejudices against it still exist, its utility is not carried to such an extent as it would be if enforced by government; nevertheless, this country has a security in the Vaccine Institution, that the blessing, for such it is, will be perpetuated.

water; the general introduction of vaccination; and, though last, not least, the advancement of medical science.

The immense importance of the last cause is well, though hyperbolically expressed, in the words of one of our most able reviews. "There is not a medical prejudice which has not slain its thousands, nor a false theory which has not immolated its tens of thousands: the system of medicine and surgery which is established in any country, has a greater influence over the lives of its inhabitants than the epidemic diseases produced by its climate, or the decision of its government concerning peace or war: the devastations of the yellow fever will bear no comparison with the ravages committed by the Brownonian system; and the slaughter of the field of Waterloo counts not of victims a tithe of the number of which the Cullenian doctrine of debility can justly boast."*

What is the extent of the improvement in the probabilities of life; whether it affects all ages after infancy, all classes of society, and both sexes equally or unequally, and if unequally, in what ratios; and in what degree it has contributed to the increase in the number of the living, evidenced by the population returns, are interesting enquiries; but in the present state of our know-

* Westminster Review, No. III. page 79.

ledge, remain to be answered: I am disposed to conjecture, that the poorer class and the male sex have felt the alteration most.*

On comparing the present with the ancient duration of life, we see no reason to suppose that it has been materially shortened during upwards of three thousand years.

* The most extravagant notions at present prevail respecting the lengthened duration of human life, (a specimen of which we have just given,) without the shadow of any well authenticated facts to support them. Sober reflection, however, will see the absurdity of calculating upon more than a gradual and circumscribed improvement, and viewing the present aspect of society, will also perceive that causes are operating, which if they do not produce a retrogression, cannot fail to check the progress of a general improvement in the probabilities of life, and also the increase of the population; among which may be mentioned emigration, which at present is going on to an unprecedented extent; the mental anxiety and consequent invasion of the health of multitudes among the trading and agricultural classes, occasioned by the difficulty of maintaining their situation in life, or indeed gaining a subsistence; the diminished, if not suspended progress of vaccination towards the extermination of small pox; and the fearful increase of pauperism and crime.

The reasons assigned by the Committee of Police for the last mentioned, are, increased drunkenness among the lower class, from the reduced price of British spirits, and parental neglect of their children. Crime is stated in the Report of the Committee, to have increased since 1801 thirty-six per cent. after making an allowance of nineteen per cent. for augmented population. It is a melancholy reflection, that the necessities of the State should make the moral character of the people subordinate to financial policy.

The psalm attributed to Moses, fixes the ordinary limit of a mature age at seventy years, and adds, that the strength which attains a longer term is but labour and sorrow; and we cannot any where find a more striking description of the present condition of human existence.

Lord Bacon, in his book, *de Vita et Morte*, notices this, and infers that the term of human life has not been abridged since the time of Moses; but Whiston, in his Chronology of the Old Testament, with some plausibility, maintains that the gradual diminution of life which succeeded the deluge did not reach its limit until about the time of David, and supports his position by adducing the following series:— Miriam, whom he ascertained to have reached about 130 years; Aaron, 123; Moses, 120; Kora, Dathan, and Abiram, about 125; Joshua, 110; Rahab, about 135; Boaz, 125; Obed, about 110; Eli, 98; Jesse, about 95; Barzillai, about 80; and David, 70; who is the first that is said at that age, to have died "full of days."

But against this it is to be observed, that the unimpaired sight and strength of Moses are mentioned as matter of wonder; and Joshua, at 85, speaks in the same tone, of his enjoying the same strength that he did at 40; and further, the regulation that the Levites were to cease from active service at the age of 50,

seems to imply that then, as now, the bodily powers began to fail about that age.

In Lord Bacon's work will be found an interesting collection and comparison of ancient and modern instances of longevity. Some of the former, it is true, are fabulous; but they do not appear to have deceived the illustrious author: the character and circumstances of each life are noticed with brevity, but with discrimination, and in accordance with the foregoing: the instances in the well known dialogue of Cicero de Senectute, tend to the same general conclusion.

Some remarkable instances of longevity are recorded by Pliny, on the authority of a census, taken in his own time under Vespasian: he says, that in the eighth region of Italy, which appears to have been the district lying on the right bank of the Po, from Piacenza to its mouth, and extending to the Appenines and Rimini southwards, fifty-four persons were returned of the age 100; fourteen of 110; two of 125; four of 135, or 137; and three of 140. I quote from Brotiér's edition, printed at Paris, by Barbou, 1779. He previously mentions particular instances, in various towns within the district, among which are three of 150 years at Bologna, Rimini, and a town called Veleiatium, which D'Anville states to be now in ruins.

This census appears to furnish more instances

of extreme longevity than could probably be found in all Europe at present; but the probability is, that the memory and faculties of most of these persons must have been impaired, and that their friends being ignorant of their true age, formed exaggerated conjectures about it: the total number above one hundred years of age; namely, eighty-one, is by no means incredible or even surprising, considering what the population of the district must have been at that time.*

A remarkable instance of the application of the laws of human mortality occurs in Sir Isaac Newton's system of chronology; he thought that the generations of men and reigns of kings appeared to occupy a greater space in ancient than in modern history; and assuming very reasonably, that the average rate of mortality had not varied materially, proceeded to apply this rule to the particular cases before him.

* In the *official* return of deaths throughout the Russian Empire during the year 1828, (the district of Tobolsk excepted,) it is stated, that out of the whole number, namely, 607,233,894 were above 100 years of age, sixteen of whom had passed their 120th year; that in the diocese of Saratoff alone, out of 18,542, seventy-two were above 100 years; and that in the diocese of Moscow, one person had passed the hundred and fiftieth year. These, with various other well authenticated instances of longevity, in our own as well as other countries, at different periods up to the present time, tend to corroborate the inference of Lord Bacon.

As a theory, his system is an extraordinary specimen of intellectual acuteness, and its symmetry and plausibility are such, that one can hardly avoid wishing it to be true; but as it is not founded on testimony, and is sometimes directly opposed to it, it is to be feared, that for once we must question the conclusions of Newton himself.

An average applied on a limited scale is necessarily inconclusive, and though the seven Kings of Rome are recorded by historians to have reigned 244 years, the testimony is by no means incoherent or incredible in detail; and it is therefore too much to reduce the period to 115 years, by reasoning on the average of English, French, or Jewish reigns: the subject almost defies calculation.

Not to mention the ephemeral reigns of the Roman Emperors, the period of seventy-five years in our own history, from 1483 to 1558, comprises six entire reigns; while the successive reigns of the 14th and 15th Louis, fill 130 years of the history of France; a longer period than is assigned to any two successive reigns in ancient history, to my knowledge, after the fabulous ages.

The connexion of the science with political economy, must immediately strike every one; its bearing on the subject of population has been anticipated, but there is one important

point of view in which it remains to be considered.

The number of the population—the balance of trade—the wages of labour—and, more recently and ably, the profits of stock, have been held forth by their respective advocates as tests of national prosperity; but perhaps the duration of human life is a still better barometer than any of the foregoing, for measuring the sum total of enjoyment attained by the bulk of a people at different periods.

It does not seem properly to be applicable to the comparison of different nations with each other; for there may exist, and in most cases probably does exist, a permanent difference in bodily constitution, but an ascertained increase or diminution in the mortality of the same nation, must certainly be attributed to a variation in the quantity of physical suffering to which the inhabitants are exposed, either immediately or through the well known influence of the mind over the body.

We may therefore indulge a hope, that notwithstanding the severe trials to which the poorer classes have been at times exposed, and the reduced value of that labour which is their only wealth, their share of comfort has, upon the whole, received some addition, though apparently not commensurate with the exertions which have been made purposely to promote it,

and the general advancement of the arts which might be expected indirectly to contribute to it; yet, if good has been visibly done, and evil still more conspicuously prevented, it is a proof of the efficacy of human exertions, which ought to weigh with the legislature as well as with the private philanthropist.

The lives, as well as the happiness of our fellow-creatures, may be increased through human instrumentality;* and among the most important of the means are, the abolition of all impediments to industry, the encouragement of persevering economy by appropriate institutions, and that portion of education which will enable the poor to discern and pursue their true interest, generate in them habits of self-restraint, and

* In illustration of the justness of this sentiment, the following institutions may be noticed:—Infant Schools; the Commission for investigating Public Charities, (though parliamentary); Mechanics' Intitutes; the Society for the Diffusion of Useful Knowledge; and the London University; and though a union of individual exertion was necessary for their accomplishment, the four last mentioned are mainly attributable to that comprehensive mind, which, in addition to a sedulous and efficient discharge of professional and legislative duties, finds time to apply itself to the promotion of the best interests of his more humble fellow-creatures, with an energy and assiduity unparalleled, and with feelings of the most exalted benevolence.

Future ages, reaping the fruit of his philanthropic labours, will not fail to enrol in the list of the illustrious benefactors of his country and mankind, the name of Brougham.

qualify them for bearing prosperity with moderation, and adversity with fortitude.

There is yet one remark more which I must be permitted to make, as it is naturally suggested by the subject we have considered; namely, the adaptation by providence of the length of human life to the interests of the world—if shorter, it would not suffice for improvement—if longer, it would obstruct it.

A truly Christian philosopher, who, with the great Bacon, might well "bequeath his name and memory to the next ages," thus expresses himself:—

"Least of all can I expect to make any impression on those who are advanced in life: my chief expectations are from the young, and from posterity; and it is happy for the cause of truth, as well as other valuable purposes, that man is mortal, and that while the species continues, the individuals go off the stage; for otherwise, the whole species would soon arrive at its maximum in all improvements, as individuals now do."

The other valuable purposes to which the writer alludes, are not less important than that of knowledge: it is painful even to imagine the extensive misery and debasement which the prolonged life of an Atila, a Mohammed, a Nader Shaw, a Philip of Spain, or a Charles of Sweden, would occasion; but the present

constitution of humanity reverses our poet's sentiment,

> " The evil that men do lives after them ;
> The good is oft interred with their bones."

For the evil which men too often waste their lives and their powers in labouring to effect, after accomplishing its intended purpose, sooner or later disappears, and is seen no more; but the works of genius and science, of benevolence and piety, are a permanent inheritance which succeeding ages receive and retain.

The intellectual wealth, then, which is bequeathed to us, is a capital to begin with, which we ought to leave duly improved to our successors; in the prosecution of this object, public institutions may be termed our saving banks; for they preserve and accumulate those earnings which might otherwise be lost, or at least lie unproductive, and from the trifling contributions of individuals there arises in due time a large collective sum.

APPENDIX.

TABLE I.

Total of Burials in the City of Bristol and Bedminster, from 1813 *to* 1822, *inclusive.*

List of the respective Burying Grounds.	1813 to 1817.	1818 to 1822.	Total.
All Saints	149	8	279
Christ Church		82	
Cathedral		40	
Saint Augustine	675	508	1183
Saint James	873	961	1834
Saint John	63	74	137
Saint Mary Redcliff	579	751	1330
Saint Mary-le-Port	75	53	128
Saint Michael	532	577	1109
Saint Nicholas	136	150	286
Saint Paul.....	388	463	851
Saint Peter.....	131	128	259
Saint Philip and Jacob.....	1206	1231	2437
Saint Stephen	165	187	352
Saint Thomas	112	151	263
Saint Werburgh	23	31	54
Saint Mary (Bedminster)....	605	660	1265
Temple, or Holy Cross.....	953	950	1903
Total, from Parish Registers	6665	7005	13670
Brunswick Square Burying Ground	167	163	330
Baptists'	297	239	536
Friends'.....	137	127	264
Tabernacle	464	491	955
City	187	147	334
Portland Chapel.....	182	156	338
Moravian, Catholic, &c.....		78	78
Undertakers' Grounds	2027	2034	4061
Total from all other Registers	3461	3435	6896
Grand Total in 10 Years..	10126	10440	20566

OBSERVATIONS.

To secure correctness, I personally extracted from the various registers, the burials, with the respective ages of the deceased, during the ten years specified in the annexed Table, from which the five following Tables were deduced, rejecting only casualties, suicides, and criminals: and it is with pleasure I avail myself of this opportunity to convey my thanks to all those to whom the care of the different registers were confided, for the facilities afforded me on the occasion, particularly to the Clergymen of the Establishment, some of whom were kind enough to render me personal assistance.

I have nearly completed a third series of five years observations, which I may confidently state will corroberate the deductions from the two preceding series of five years, though I deem it unnecessary to delay the publication of this work on account of them; the result however shall be annexed to the original MS. deposited in the Bristol Institution.

It is remarkable, that exactly nine persons in each period of five years died above the age of 98: in the first period, one exceeded the age of 108 years, and in the second, one attained the age of 109: of these, the majority were inmates of almshouses, and two-thirds were females.

TABLE II.

Probabilities and Expectations of Life in Bristol, reduced to a Radix of 10,000.

Age.	Living.	Decrement.	Expectation.	Age.	Living	Decrement.	Expectation.	Age.	Living	Decrement.	Expectation.
0	10000	1903	28.78	33	4112	78	26.51	66	1501	84	10.56
1	8097	858	34.42	34	4034	81	26.01	67	1417	82	10.15
2	7239	545	37.44	35	3953	81	25.53	68	1335	82	9.75
3	6694	372	39.45	36	3872	81	25.06	69	1253	78	9.35
4	6322	231	40.74	37	3791	81	24.58	70	1175	78	8.94
5	6091	160	41.27	38	3710	78	24.11	71	1097	77	8.54
6	5931	108	41.37	39	3632	78	23.61	72	1020	77	8.15
7	5823	100	41.13	40	3554	78	23.12	73	943	77	7.77
8	5723	76	40.84	41	3476	77	22.63	74	866	72	7.42
9	5647	57	40.38	42	3399	77	22.13	75	794	72	7.04
10	5590	57	39.79	43	3322	77	21.63	76	722	72	6.70
11	5533	49	39.19	44	3245	77	21.13	77	650	64	6.38
12	5484	44	38.54	45	3168	77	20.63	78	586	60	6.03
13	5440	44	37.85	46	3091	77	20.14	79	526	60	5.66
14	5396	44	37.15	47	3014	77	19.64	80	466	59	5.32
15	5352	42	36.45	48	2937	77	19.14	81	407	57	5.02
16	5310	42	35.74	49	2860	73	18.64	82	350	54	4.75
17	5268	45	35.02	50	2787	73	18.12	83	296	52	4.53
18	5223	60	34.32	51	2714	73	17.59	84	244	40	4.39
19	5163	70	33.71	52	2641	73	17.06	85	204	34	4.15
20	5093	70	33.17	53	2568	73	16.53	86	170	30	3.88
21	5023	75	32.62	54	2495	77	16.00	87	140	26	3.61
22	4948	75	32.11	55	2418	77	15.50	88	114	23	3.31
23	4873	75	31.59	56	2341	79	14.99	89	91	20	3.03
24	4798	75	31.08	57	2262	79	14.50	90	71	17	2.74
25	4723	75	30.57	58	2183	86	14.00	91	54	15	2.44
26	4648	75	30.05	59	2097	86	13.56	92	39	12	2.20
27	4573	75	29.53	60	2011	86	13.11	93	27	9	1.94
28	4498	77	29.02	61	1925	86	12.68	94	18	7	1.67
29	4421	77	28.52	62	1839	86	12.25	95	11	5	1.41
30	4344	77	28.01	63	1753	84	11.82	96	6	3	1.17
31	4267	77	27.51	64	1669	84	11.39	97	3	2	83
32	4190	78	27.00	65	1585	84	10.97	98	1	1	50

OBSERVATIONS.

The probabilities and expectations in this Table nearly coincide with those in the Northampton Tables, with which they ought to be compared, the Tables being constructed upon the same principle. I have not, however, attempted a correction, to countervail the influence of migration, increased population, &c. because such correction could not be verified, and of course would be too vague to be relied on, with a view to practical utility; though I feel assured, that the result would be a much nearer approximation to the true rate of mortality, among the population at large, than either the Northampton or Carlisle Table.

The following is a statement of the remarkable excess in the deaths at the decimal years, in the advanced periods of life, referred to in page 52; and I find that a similar disparity prevails in the third series of five years.

Ages.....	49	50	51	59	60	61	69	70	71	79	80	81
Deaths,												
First 5 years...	62	119	55	57	146	75	58	134	55	32	101	43
Second 5 years..	65	134	39	75	173	64	74	163	66	51	111	44

Mr. Milne, in his Carlisle Table, has made the limit of life 105 years, and has calculated the expectations up to that age, exhibiting the striking anomaly, of the expectation at 95 exceeding that at 89 years; and his Annuity Table being calculated on the same basis, displays, of course, the the same incongruity.

It is true, that he notices this paradox, and that he reasons upon it, but his reasoning fails to satisfy my mind; for, thinking that all lives above 98 years are exceptions to nature's general rule, I have made that age the limit of life in this table. Mr. Morgan says, that "only one life assured by the Equitable Office has reached the age of ninety-four, since its first establishment."!

TABLE III.

Probabilities and Expectations of Life among the Poor of the City of Bristol.

Age.	Living	Decrement.	Expectation.	Age.	Living	Decrement.	Expectation.	Age.	Living	Decrement.	Expectation.
0	4061	1007	20.36	31	1185	21	26.72	61	503	26	11.94
1	3054	450	25.90	32	1164	21	26.20	62	477	25	11.56
2	2604	364	29.26	33	1143	21	25.67	63	452	25	11.17
3	2240	236	32.98	34	1122	21	25.14	64	427	25	10.80
4	2004	130	35.80	35	1101	23	24.61	65	402	21	10.44
5	1874	85	37.25	36	1078	23	24.12	66	381	21	9.99
6	1789	52	37.99	37	1055	23	23.64	67	360	21	9.54
7	1737	42	38.12	38	1032	22	23.15	68	339	21	9.13
8	1695	32	38.05	39	1010	22	22.65	69	318	21	8.67
9	1663	30	37.77	40	988	22	22.14	70	297	21	8.25
10	1633	26	37.46	41	966	22	21.63	71	276	20	7.84
11	1607	26	37.05	42	944	22	21.13	72	256	20	7.41
12	1581	26	36.65	43	922	20	20.62	73	236	19	7.00
13	1555	26	36.26	44	902	20	20.06	74	217	19	6.57
14	1529	20	35.87	45	882	20	19.51	75	198	18	6.15
15	1509	13	35.34	46	862	20	18.95	76	180	18	5.72
16	1496	13	34.64	47	842	23	18.39	77	162	18	5.30
17	1483	13	33.94	48	819	23	17.89	78	144	17	4.89
18	1470	24	33.23	49	796	23	17.39	79	127	16	4.48
19	1446	24	32.78	50	773	23	16.90	80	111	16	4.06
20	1422	24	32.32	51	750	23	16.40	81	95	15	3.66
21	1398	24	31.87	52	727	24	15.90	82	80	14	3.25
22	1374	22	31.42	53	703	24	15.43	83	66	13	2.83
23	1352	22	30.92	54	679	24	14.95	84	53	13	2.41
24	1330	22	30.42	55	655	24	14.48	85	40	12	2.02
25	1308	22	29.93	56	631	24	14.00	86	28	10	1.65
26	1286	20	29.43	57	607	26	13.55	87	18	8	1.33
27	1266	20	28.89	58	581	26	13.13	88	10	6	1.00
28	1246	20	28.34	59	555	26	12.73	89	4	3	75
29	1226	20	27.80	60	529	26	12.33	90	1	1	50
30	1206	21	27.25								

OBSERVATIONS.

The respectability of the proprietors of the private or Undertakers' cemeteries in the City of Bristol, the mode of conducting them, and the regularity of their registers, gave me an opportunity of ascertaining with more correctness the rate of mortality among the lowest class, than perhaps any other place in the kingdom can afford. Having availed myself of it, I now present to those, if any such there are, who doubt the appalling effect of penury and its accompanying evils on the duration of life, a document which will at once remove such doubt.

Though this Table may, from causes before noticed, represent the probabilities and expectations somewhat too unfavourably, yet, after making a larger allowance than the truth requires, a comparison with the preceding Table, (which includes the 4061 poor from which this Table was deduced,) will show a large and melancholy balance, in respect of human existence, against the indigent. But when put in comparison with the lengthened duration of life, (unquestionably resulting from circumstances of a contrary character to those connected with poverty and destitution,) as exhibited in the succeeding Table, where is the heart so callous as not to feel sympathy and compassion towards our more humble fellow-creatures, and a desire to alleviate their sufferings and improve their condition.

It is worthy of remark, that most of those who attain an advanced age, are either members, or the widows of members, of Friendly and Benefit Societies.

TABLE IV.

Probabilities and Expectations of Life among the Society of Friends, in Bristol.

Age.	Living	Decrement.	Expectation.	Age.	Living	Decrement.	Expectation.	Age.	Living	Decrement.	Expectation.
0	264	37	40.40	31	155	1	32.55	61	95	4	13.16
1	227	13	45.90	32	154	2	31.76	62	91	4	12.72
2	214	9	47.66	33	152	2	31.17	63	87	4	12.28
3	205	4	48.73	34	150	2	30.58	64	83	4	11.85
4	201	3	48.69	35	148	2	29.99	65	79	4	11.42
5	198	3	48.42	36	146	2	29.40	66	75	4	11.00
6	195	3	48.15	37	144	2	28.79	67	71	4	10.60
7	192	3	47.90	38	142	2	28.19	68	67	4	10.20
8	189	3	47.65	39	140	2	27.58	69	63	4	9.82
9	186	1	47.41	40	138	2	26.98	70	59	4	9.45
10	185	1	46.67	41	136	1	26.37	71	55	3	9.10
11	184	1	45.92	42	135	1	25.56	72	52	3	8.60
12	183	1	45.16	43	134	1	24.70	73	49	3	8.09
13	182	1	44.41	44	133	2	23.93	74	46	3	7.59
14	181	1	43.65	45	131	3	23.29	75	43	3	7.08
15	180	1	42.90	46	128	3	22.82	76	40	3	6.57
16	179	1	42.13	47	125	3	22.35	77	37	3	6.07
17	178	1	41.37	48	122	3	21.90	78	34	3	5.56
18	177	2	40.59	49	119	3	21.43	79	31	3	5.05
19	175	2	40.05	50	116	1	20.97	80	28	3	4.54
20	173	2	39.51	51	115	1	20 15	81	25	4	4.02
21	171	2	38.97	52	114	1	19.32	82	21	4	3.69
22	169	2	38.42	53	113	2	18.49	83	17	3	3.44
23	167	2	37.88	54	111	2	17.81	84	14	3	3.07
24	165	2	37.33	55	109	2	17.13	85	11	2	2.77
25	163	2	36.78	56	107	2	16.44	86	9	2	2.28
26	161	2	36.23	57	105	2	15.75	87	7	2	1.78
27	159	1	35.62	58	103	2	15.04	88	5	2	1.30
28	158	1	34.90	59	101	2	14.33	89	3	2	83
29	157	1	34.12	60	99	4	13.61	90	1	1	50
30	156	1	33.34								

OBSERVATIONS.

This Table contains a lesson of inestimable value, for it teaches us how to extend human existence and augment its happiness. The moral habits for which the members of the Society of Friends are proverbially eminent, tend as certainly to the prolongation and enjoyment of life, as their opposites tend to abridge and embitter it. This fact, established in every rational mind, is corroberated by the probabilities and expectations now before us, which, for the following reasons, may be considered as a close approximation to the truth :— namely, The uniformity in the deaths recorded in the Society's register, (which, as may be supposed, is kept with peculiar regularity and correctness,) both as to the annual number and the respective ages, for a long series of years; the exemption of this class from military service; its general avoidance of all hazardous and unhealthy occupations; the indisposition to migration; and the immaterial fluctuation of its numbers.

The following anecdote, communicated to me by a highly respectable member of this respected Society, may not be deemed unappropriate here.

Some years ago he effected an insurance on his life, at one of the principal offices in London, on which occasion the Actuary observed, that so important were temperate habits deemed by the office, that its business was materially influenced by the consideration of them, in reference to persons applying for assurance : " For instance," said he, " while we are anxious to insure the members of your society in preference to those of any other body, we invariably reject aldermen."

TABLE V.

Probabilities and Expectations of Life in the Parish of St. George, Kingswood, Gloucestershire.

Age.	Living	Decrement.	Expectation.	Age.	Living	Decrement.	Expectation.	Age.	Living	Decrement.	Expectation.
0	811	183	29.34	33	327	5	29.21	65	141	7	11.89
1	628	64	36.75	34	322	5	28.65	66	134	7	11.49
2	564	34	39.86	35	317	5	28.10	67	127	7	11.09
3	530	21	41.39	36	312	5	27.54	68	120	7	10.71
4	509	12	42.07	37	307	6	26.98	69	113	7	10.34
5	497	12	42.08	38	301	6	26.51	70	106	7	9.99
6	485	12	42.11	39	295	6	26.04	71	99	6	9.66
7	473	8	42.16	40	289	6	25.57	72	93	6	9.25
8	465	7	41.88	41	283	4	25.10	73	87	6	8.86
9	458	7	41.51	42	279	4	24.45	74	81	6	8.47
10	451	5	41.15	43	275	4	23.80	75	75	7	8.11
11	446	5	40.60	44	271	4	23.14	76	68	7	7.90
12	441	5	40.06	45	267	4	22.48	77	61	5	7.75
13	436	5	39.51	46	263	2	21.81	78	56	5	7.39
14	431	5	38.96	47	261	2	20.98	79	51	5	7.07
15	426	4	38.41	48	259	2	20.14	80	46	5	6.78
16	422	4	37.77	49	257	2	19.29	81	41	4	6.52
17	418	4	37.13	50	255	4	18.44	82	37	4	6.20
18	414	5	36.49	51	251	4	17.72	83	33	3	5.90
19	409	5	35.92	52	247	7	17.00	84	30	3	5.43
20	404	6	35.36	53	240	7	16.48	85	27	3	4.98
21	398	6	34.89	54	233	9	15.96	86	24	3	4.54
22	392	6	34.41	55	224	9	15.58	87	21	3	4.12
23	386	6	33.94	56	215	9	15.21	88	18	3	3.72
24	380	6	33.47	57	206	9	14.86	89	15	3	3.37
25	374	6	33.00	58	197	8	14.51	90	12	2	3.08
26	368	7	32.53	59	189	8	14.11	91	10	2	2.60
27	361	7	32.15	60	181	8	13.71	92	8	2	2.12
28	354	7	31.78	61	173	8	13.32	93	6	2	1.67
29	347	5	31.41	62	165	8	12.94	94	4	2	1.25
30	342	5	30.86	63	157	8	12.58	95	2	1	1.00
31	337	5	30.31	64	149	8	12.22	96	1	1	50
32	332	5	29.76								

OBSERVATIONS.

This Table was constructed, principally with a view to a comparison of the probabilities and expectations with those in the City of Bristol and Parish of Clifton, anticipating, however, the result; namely, a superiority over the former, and a similarity to the latter: though the population of this well known coal district consists principally of colliers, and persons in the middle and lower ranks of life, such is the advantage of the country with regard to health, that all classes participate in it.

TABLE VI.

Probabilities and Expectations of Life in the Parish of Clifton, Gloucestershire.

Age.	Living	Decrement.	Expectation.	Age.	Living	Decrement.	Expectation.	Age.	Living	Decrement.	Expectation.
0	784	141	31.53	33	347	5	28.42	65	148	6	11.78
1	643	58	37.34	34	342	5	27.82	66	142	6	11.26
2	585	29	39.99	35	337	5	27.23	67	136	6	10.73
3	556	27	41.05	36	332	6	26.63	68	130	6	10.21
4	529	15	42.12	37	326	6	26.11	69	124	6	9.52
5	514	9	42.33	38	320	6	25.59	70	118	8	9.14
6	505	9	42.08	39	314	6	25.07	71	110	8	8.77
7	496	9	41.83	40	308	6	24.55	72	102	8	8.42
8	487	9	41.60	41	302	6	24.03	73	94	8	8.09
9	478	8	41.37	42	296	6	23.51	74	86	8	7.80
10	470	8	41.07	43	290	6	22.98	75	78	8	7.55
11	462	4	40.77	44	284	5	22.46	76	70	6	7.36
12	458	4	40.12	45	279	5	21.85	77	64	6	7.00
13	454	4	39.47	46	274	5	21.24	78	58	6	6.67
14	450	4	38.82	47	269	5	20.63	79	52	6	6.38
15	446	5	38.17	48	264	5	20.01	80	46	6	6.15
16	441	5	37.59	49	259	5	19.40	81	40	4	6.00
17	436	5	37.01	50	254	5	18.77	82	36	4	5.61
18	431	5	36.44	51	249	7	18.12	83	32	4	5.25
19	426	5	35.86	52	242	7	17.63	84	28	4	4.93
20	421	5	35.28	53	235	8	17.14	85	24	3	4.67
21	416	5	34.70	54	227	8	16.73	86	21	3	4.26
22	411	6	34.11	55	219	8	16.32	87	18	3	3.89
23	405	6	33.61	56	211	7	15.92	88	15	3	3.57
24	399	6	33.11	57	204	7	15.45	89	12	2	3.33
25	393	6	32.61	58	197	7	14.98	90	10	2	2.90
26	387	6	32.10	59	190	7	14.50	91	8	2	2.50
27	381	6	31.60	60	183	7	14.05	92	6	2	2.17
28	375	6	31.10	61	176	7	13.59	93	4	1	2.00
29	369	6	30.60	62	169	7	13.13	94	3	1	1.50
30	363	6	30.09	63	162	7	12.68	95	2	1	1.08
31	357	5	29.59	64	155	7	12.23	96	1	1	50
32	352	5	29.00								

OBSERVATIONS.

The great influx of persons to Clifton, both as visitors and permanent residents, rendered a correct exclusion of the deaths among them from this Table almost impracticable. With the assistance, however, of the Clerk of the parish, who had held the office for nearly ten years, I was enabled so to approximate the truth, as to be quite confident that every additional step towards it would exhibit the duration of life in this parish in a more favourable point of view—it would, now, from the vastly increased, and still rapidly increasing population, (principally from immigration,) be impossible to form a Table from the burial register of the parish with the least pretension, even to an approximation to the true rate of mortality amongst its inhabitants.

As a very large proportion of the inhabitants of this parish are of the lower class, and as its local advantage with respect to health cannot be materially different from that of its almost neighbouring parish of St. George, the probabilities and expectations may, without material error, be considered nearly on a par.

TABLE VII.

A Comparative Table of the value of an Annuity on a required by the different Offices for Assuring £.100 on a

	1	2	3	4	5	6	7	8
Age.	Equitable Exp. Values.	Carlisle Values.	North-ampton Values.	Asylum.	Promoter.	Economic.	British Commer-cial.	Pelican.
10	23.540	23.512	20.663					
11	23.320	23.327	20.480	23.168				
12	23.130	23.143	20.283	23.023				
13	22.940	22.957	20.081	22.857				
14	22.750	22.769	19.872	22.694			21.920	
15	22.550	22.582	19.657	22.506	22.209	21.901	21.662	21.179
16	22.360	22.404	19.435	22.323	22.010	21.706	21.408	20.977
17	22.160	22.232	19.218	22.107	21.812	21.512	21.160	20.797
18	21.960	22.058	19.013	21.922	21.641	21.323	20.917	20.602
19	21.770	21.879	18.820	21.726	21.430	21.121	20.680	20.390
20	21.572	21.694	18.638	21.514	21.242	20.902	20.447	20.200
21	21.376	21.504	18.470	21.303	21.038	20.718	20.219	20.032
22	21.181	21.304	18.311	21.099	20.817	20.505	19.996	19.896
23	20.980	21.098	18.148	20.878	20.602	20.276	19.778	19.707
24	20.772	20.885	17.983	20.660	20.351	20.034	19.563	19.531
25	20.566	20.665	17.814	20.428	20.125	19.796	19.355	19.339
26	20.352	20.442	17.642	20.201	19.887	19.547	19.156	19.100
27	20.132	20.212	17.467	19.979	19.634	19.287	18.949	18.834
28	19.953	19.981	17.289	19.744	19.372	19.033	18.752	18.574
29	19.725	19.761	17.107	19.512	19.134	18.801	18.559	18.340
30	19.493	19.556	16.922	19.268	18.918	18.574	18.370	18.123
31	19.253	19.348	16.732	19.033	18.704	18.355	18.184	17.892
32	19.055	19.134	16.540	18.785	18.479	18.136	18.002	17.677
33	18.810	18.910	16.343	18.528	18.245	17.898	17.823	17.433
34	18.555	18.675	16.142	18.261	17.986	17.647	17.561	17.181
35	18.292	18.433	15.938	17.986	17.720	17.377	17.306	16.909
36	18.020	18.183	15.729	17.707	17.467	17.119	16.896	16.647
37	17.741	17.928	15.515	17.419	17.196	16.844	16.659	16.378
38	17.459	17.669	15.298	17.122	16.896	16.557	16.429	16.093
39	17.166	17.405	15.075	16.829	16.633	16.276	16.204	15.818
40	16.854	17.143	14.848	16.531	16.353	16.009	15.913	15.540
41	16.540	16.890	14.620	16.229	16.081	15.736	15.631	15.206
42	16.222	16.640	14.391	15.924	15.818	15.472	15.359	14.883

TABLE VII.

Single Life, corresponding with the Annual Premium Single Life, at the respective ages, at 3 per cent. interest.

	9	10	11	12	13	14	15	16
Age.	Sun and Alliance.	European.	Crown.	Amicable.	Guardian.	Clerical and Medical.	Eagle.	University.
10							21.018	
11							20.817	
12							20.602	
13							20.370	
14			20.486	20.562	20.390	20.447	20.125	20.278
15	20.999	20.778	20.278	20.332	20.219	20.238	19.887	20.072
16	20.798	20.581	20.089	20.107	19.960	20.032	19.635	19.832
17	20.621	20.369	19.904	19.887	19.744	19.832	19.412	19.635
18	20.428	20.183	19.724	19.673	19.531	19.634	19.201	19.445
19	20.219	19.979	19.548	19.459	19.339	19.443	19.013	19.235
20	20.014	19.761	19.372	19.252	19.154	19.252	18.850	19.065
21	19.796	19.565	19.187	19.049	18.983	19.065	18.688	18.884
22	19.580	19.372	18.999	18.850	18.820	18.884	18.592	18.737
23	19.339	19.187	18.801	18.655	18.655	18.704	18.497	18.559
24	19.100	18.983	18.606	18.464	18.479	18.528	18.401	18.416
25	18.850	18.801	18.401	18.276	18.311	18.340	18.276	18.211
26	18.606	18.592	18.215	18.092	18.123	18.154	18.154	18.062
27	18.340	18.401	18.006	17.912	17.943	17.972	18.001	17.898
28	18.078	18.215	17.814	17.735	17.765	17.794	17.853	17.721
29	17.802	18.006	17.619	17.561	17.561	17.604	17.677	17.532
30	17.620	17.814	17.419	17.390	17.377	17.419	17.543	17.345
31	17.394	17.604	17.225	17.225	17.166	17.225	17.320	17.155
32	17.166	17.390	17.019	17.058	16.977	17.031	17.140	16.977
33	16.924	17.166	16.806	16.806	16.765	16.829	16.937	16.778
34	16.672	16.950	16.608	16.582	16.557	16.633	16.732	16.582
35	16.405	16.732	16.390	16.353	16.353	16.428	16.506	16.365
36	16.142	16.505	16.178	16.130	16.130	16.229	16.278	16.154
37	15.867	16.276	15.928	15.913	15.913	16.020	16.045	15.940
38	15.588	16.045	15.748	15.701	15.688	15.818	15.806	15.729
39	15.303	15.806	15.515	15.494	15.460	15.609	15.562	15.506
40	15.032	15.562	15.282	15.223	15.223	15.404	15.315	15.282
41	14.769	15.326	15.042	14.969	14.999	15.083	15.064	15.055
42	14.503	15.064	14.799	14.718	14.758	14.969	14.799	14.831

TABLE VII.—Continued.

A Comparative Table of the value of an Annuity on a required by the different Offices for Assuring £.100 on a

	1	2	3	4	5	6	7	8
Age.	Equitable Exp. Values.	Carlisle Values.	Northampton Values.	Asylum.	Promoter.	Economic.	British Commercial.	Pelican.
43	15.893	16 389	14.162	15.620	15.562	15.216	15.096	14.554
44	15.581	16.130	13.929	15 315	15.298	14.947	14.838	14.228
45	15.244	15.863	13.692	14.989	15.021	14.676	14.594	13.888
46	14.895	15.585	13.450	14.645	14.726	14.384	14.237	13.607
47	14.565	15.294	13.203	14.286	14.423	14.084	13.882	13.311
48	14.212	14.986	12.951	13.888	14.103	13.760	13 589	12.994
49	13.853	14.654	12.693	13.484	13.760	13.414	13.234	12.659
50	13.481	14.303	12.436	13.076	13.397	13.051	12.816	12.296
51	13.114	13.932	12.183	12.675	13.002	12.667	12.415	11.918
52	12.778	13.558	11.930	12.281	12.613	12.273	12.007	11.540
53	12.412	13.180	11.674	11.896	12.215	11.882	11.665	11.152
54	12.045	12.798	11.414	11.513	11.813	11.493	11.402	10.776
55	11.652	12.408	11.150	11.145	11.422	11.096	11.139	10.390
56	11.287	12.014	10.882	10.787	11.006	10.695	10.816	9.999
57	10.921	11.614	10.611	10.439	10.591	10.288	10.577	9.605
58	10.561	11.218	10.337	10.100	10.199	9.894	10.283	9.221
59	10.200	10.841	10.058	9.771	9.820	9.521	9.973	8.864
60	9.846	10.491	9.777	9.487	9.466	9.173	9.650	8.531
61	9.553	10.180	9.493	9.148			9.349	
62	9.264	9.875	9.205	8.795			8.962	
63	8.968	9.567	8.910	8.535			8.603	
64	8.646	9.246	8.611	8.216			8.200	
65	8.337	8.917	8.304	7.840			7.760	
66	7.994	8.578	7.994	7.465				
67	7.682	8.228	7.692	7.105				

TABLE VII.—CONTINUED.

Single Life, corresponding with the Annual Premium Single Life, at the respective ages, at 3 per cent. interest.

	9	10	11	12	13	14	15	16
Age.	Sun and Alliance.	European.	Crown.	Amicable.	Guardian.	Medical and Clerical.	Eagle.	University.
43	14.247	14.811	14.535	14.473	14.514	14.718	14.514	14.594
44	13.981	14.547	14.277	14.237	14.277	14.473	14.237	14.354
45	13.715	14.288	14.009	14.009	14.018	14.237	13.934	14.113
46	13.422	14.018	13.732	13.732	13.760	13.958	13.624	13.879
47	13.134	13.743	13.458	13.466	13.501	13.678	13.302	13.624
48	12.817	13.466	13.167	13.209	13.226	13.362	12.961	13.370
49	12.476	13.193	12.880	12.961	12.954	13.059	12.620	13.022
50	12.122	12.912	12.602	12.673	12.673	12.745	12.281	12.722
51	11.734	12.635	12.307	12.400	12.400	12.445	11.936	12.422
52	11.364	12.348	12.029	12.136	12.122	12.136	11.604	12.121
53	10.988	12.050	11.759	11.882	11.847	11.840	11.276	11.827
54	10.605	11.766	11.486	11.638	11.566	11.539	10.963	11.532
55	10.225	11.441	11.207	11.364	11.276	11.250	10.610	11.226
56	9.835	11.133	10.922	11.066	10.988	10.957	10.358	10.916
57	9.448	10.805	10.644	10.783	10.688	10.678	10.044	10.611
58	9.067	10.500	10.347	10.510	10.390	10.379	9.748	10.337
59	8.708	10.183	10.075	10.220	10.085	10.095	9.482	10.058
60	8.382	9.904	9.787	9.913	9.787	9.786	9.182	9.777
61		9.595		9.624		9.493		9.493
62				9.320		9.205		9.205
63				9.037		8.910		8.910
64				8.720		8.611		8 611
65				8.400		8.304		8.304
66				8.080		7.994		7.994
67				7.762		7.682		7.682

OBSERVATIONS ON TABLE VII.

The first column of this Table exhibits the values of lives deduced from the experienced probabilities among the lives assured by the Equitable Office during a long series of years, except those under the age of twenty, which are assumed to be proportionate; and as the lives were selected with a degree of caution not to be surpassed, it may reasonably be inferred, that no Life Assurance Office can with prudence calculate upon a more favourable rate of mortality among its assured: premiums therefore corresponding with these values, would, of course, barely cover the risk, leaving nothing towards the expenses of an assurance office and unfavourable contingencies.

The second column exhibits the values of lives deduced from the Carlisle probabilities; which, as they show a lower rate of mortality than that experienced by the Equitable Office, cannot be considered as even an approximation to the rate of mortality among the population at large.

The third column exhibits the values of lives deduced from the Northampton probabilities, which continue to regulate the premiums required by the following Offices: *—

The EQUITABLE,	IMPERIAL,	PALLADIUM,
ALBION,	ROYAL EXCHANGE,	UNION,
ATLAS,	LONDON,	HOPE,
GLOBE,	PROVIDENT,	WESTMINSTER.
LAW,	ROCK.	

* Some of these vary about a penny in the annual premium, a difference too insignificant to require for them a distinct column; and it may be mentioned here, that if any error exists in the figures of the other columns, it will be too trifling to affect the object for which this Table was constructed.

Each of the other columns exhibits the values of lives corresponding with the premiums required by the Office at the head of the column, for insuring £.100 at the different ages respectively, except the column appropriated to the Eagle, which Office makes a distinction between Males and Females; the values here exhibited, therefore, are made to correspond with the premiums required for Males only.

Among this diversity, the Asylum, from the novel nature of its original business, claims individual notice. On comparing its values with those of the Equitable Experience, one might be led to suppose, (if they had been accessible at the time,) that they had been the guide of the Office, as something like a proportionate difference is preserved throughout; so small, however, that its ingenious conductor may be compared to an adventurous and enterprizing pilot, who, to "get a head" of the accompanying fleet, runs his vessel closer to a dangerous lee shore than any of his competitors dare venture; while, to pursue the simile, the timid or wary pilot of the Sun, keeps at such a distance from his own beacons (the Carlisle values,) as to imply, that they are not to be relied on. But, to return—The Asylum was established by the talent and assiduity of its managing Director, Mr. Farren, and is a scion of the Economic: it was instituted for the express purpose of assuring deteriorated lives—lives rejected by other offices, and lives avowedly diseased.

To this unprecedented, but most useful business, it was at first restricted; and the philanthropist will say, it ought to succeed; and doubtless it will succeed, if the premiums are adequate to the risks, which, in common justice to the ingenuity of its founder, it may be supposed will be the case, however difficult the due adjustment of them may appear to others.

Not long after its establishment, this office added to its original business, the assurance of select lives on lower terms, and under a greater variety of modes, than any other office; and by thus ringing changes on *equivalents*, holds out attractions well suited to the taste and circumstances of the public at the present day.

The alleged improvement in the duration of human life has given rise not only to the diversity displayed in this Table, but to the most amusing pretensions to scientific accuracy in adjusting the premiums to such alleged improvement; though it is obvious, that an arbitrary reduction of their previous amount, on the shopkeeping principle of competition, was the only process to which they were subjected. While, on another hand, the public are apprised, that, to secure to them assurance at a value corresponding to the true rate of mortality, various tables of probabilities have been mixed together, and a proper average obtained for calculating the premiums. This notable expedient is very similar to the process of making punch, though not quite so scientific, or so satisfactory in its result, for the due proportion of the respective ingredients cannot be so correctly ascertained.

It is hardly possible for words to convey a stronger sense of the importance of standard, authoritative tables of probabilities, expectations, and values of lives for the kingdom at large, than this Table conveys; and it is with satisfaction, I perceive, that, since this Work went to press, a Population Bill has been introduced into Parliament, preparatory to the census of 1831, which is likely to contain provisions calculated to supply in due time these necessary desiderata. This done, the mischievous as well as foolish notion of a great extension of human life will be effectually exposed and exploded, and due justice will be done to the venerable Actuary of the Equitable, for his steady, manly, and honorable perseverance in the course he has pursued, (in despite of the acrimonious attacks upon it,) which, alike, proves his science, his judgment, and his integrity.

This just tribute is not inconsistent with a belief that the Northampton Tables, the guides of his Office, represent the rate of mortality till about the middle period of life—(the period of the mass of life assurances,) much greater perhaps than it is; for, in the absence of more correct and authentic data, a change of system on *assumption* only, would be rash and unjustifiable speculation. And it is not too much to say, that, had the Equitable Office commenced originally with its

present premiums; had made all its investments at the present price of the Funds; had always purchased its policies at their true value; had employed agents, paid commissions for business, expended what some offices do in advertisements, and had derived no benefit from lapsed policies or other sources, its accumulations or additions to its policies would never have excited envy, or its management acrimonious animadversion.

In conclusion, I give the following comparative statement of expectations, conceiving it may be useful and interesting to the reader.

Age.	Expectations of Government Annuitants & Tontine Nominees, &c. by Mr. Finlaison*	Carlisle Expectations.	Equitable Experience Expectations	Society of Friends' Expectations.	Bristol Expectations.	Northampton Expectations.
5	51.66	51.25		48.42	41.27	40.84
10	48.31	48.82		46.67	39.79	39.78
15	44.47	45.00		42.90	36.45	37.50
20	41.19	41.46	41.11	39.51	33.17	33.43
25	38.35	37.86	37.61	36.78	30.57	30.85
30	35.37	34.34	34.08	33.34	28.01	28.27
35	32.24	31.00	30.58	29.99	25.53	25.68
40	29.07	27.61	26.95	26.98	23.12	23.08
50	22.32	21.11	19.80	20.97	18.12	17.99
60	15.85	14.34	13.63	13.61	13.11	13.21
70	10.10	9.18	8.61	9.45	8.94	8.60

* Mr. Finlaison having calculated distinct expectations for males and females, the above are the average of the two: and it will be seen on comparing them with the Equitable Experience Expectations, that they fully confirm the opinions advanced in pages 57 and 58, respecting the superior longevity of Annuitants to the lives selected by Assurance Offices.

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